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Philip, Alexander

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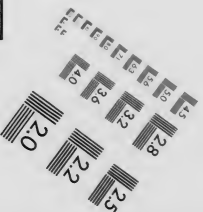
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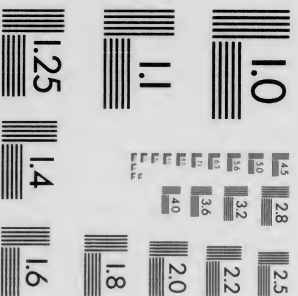
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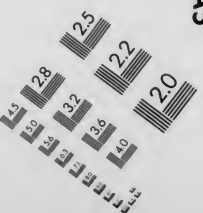
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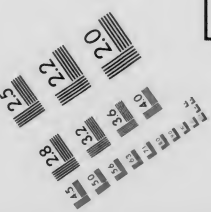


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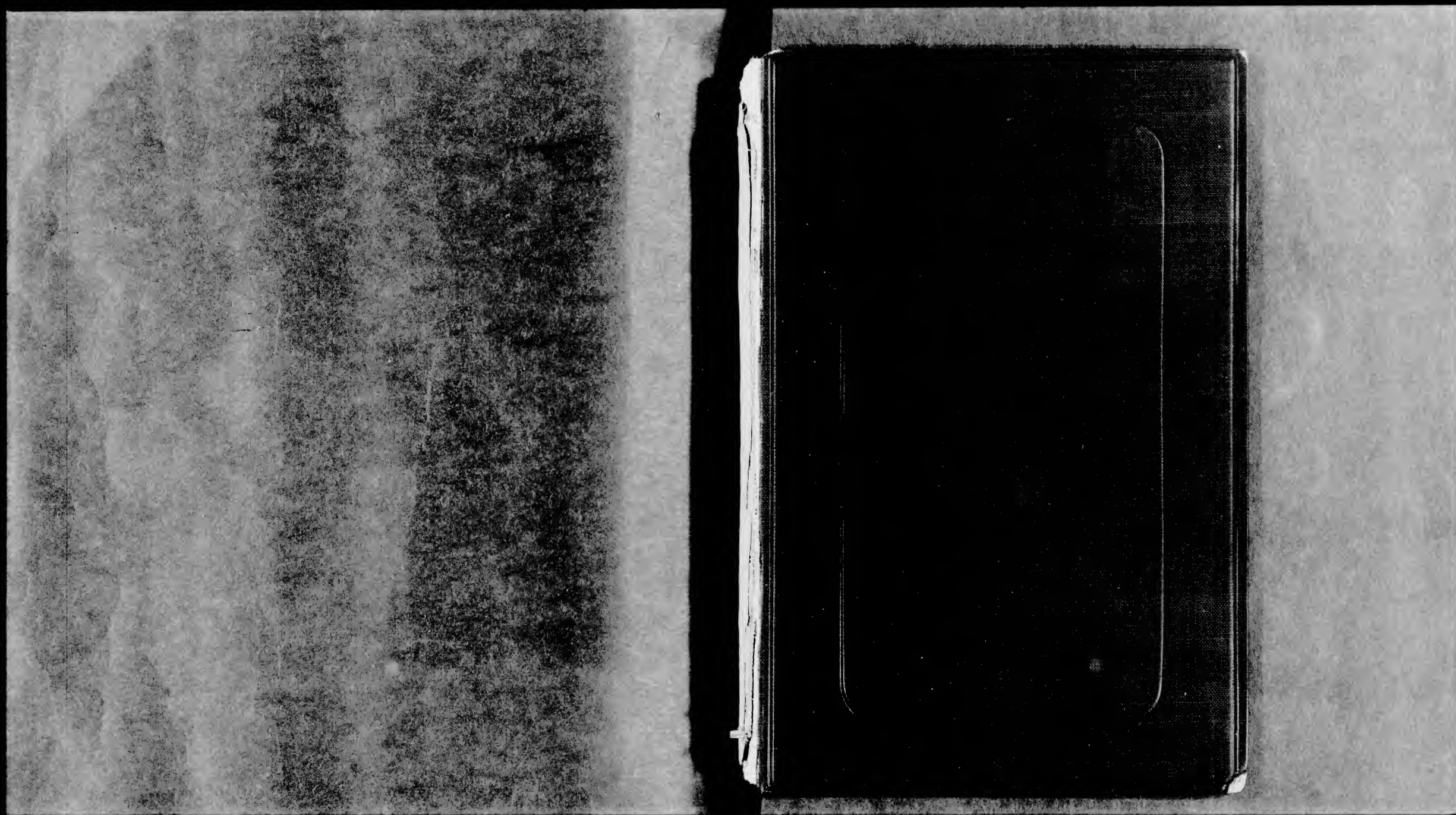
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THE FUNCTION OF LABOUR

IN THE

PRODUCTION OF WEALTH

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IN THE

PRODUCTION OF WEALTH

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NOTE.

As the following pages were in the press, there has appeared in the current number of the 'Nineteenth Century' an article by Professor Huxley, entitled "Capital—the Mother of Labour," which contains an interesting argument in support of the proposition that the essential constituent of wealth is potential energy.

BRECHIN, *March* 1890.

THE
FUNCTION OF LABOUR IN THE
PRODUCTION OF WEALTH.

I.

THE extension of comparative science has been a principal source of the progress of knowledge within recent times, and if carefully carried out, it is undoubtedly capable of still wider development. One simple and very necessary precaution is to make sure that the subject to which the results of comparative investigations are applied is in the two cases truly the same in fact as well as in name. It is easy to imagine and then expatiate upon the analogies of

the natural and the spiritual or moral worlds: it is desirable not to forget that an analogy is illustrative rather than demonstrative, and that what seems new or striking to one generation of thinkers may appear common or unobvious to the next. In attempting to apply the comparative method to certain principles which underlie the science of political economy and the law of property, we shall endeavour to keep these considerations in view.

It is, we believe, very generally acknowledged that to some such applications we must look for any prospects of genuine advance at present in the moral and still more in the social sciences. This involves no surrender to materialism, no failure to recognise the distinct sphere dominated by moral phenomena; rather the reality of such a distinct moral element will be the more clearly and more fully seen when it is most thoroughly eliminated, and when in such mixed sciences as political economy the physical or material element is definitely ascertained, and

its agency clearly explained in conformity with the principles which regulate the operation of recognised natural laws.

It is generally admitted that whilst the researches of the historical school and the criticism of the exponents of social science have seriously impaired the authority and universality of the great structure of doctrine raised up by Smith, Malthus, Ricardo, M'Culloch, and Mill, they have as yet put no generally accepted system in its place. Its theory of production more especially still stands with little alteration or addition, and is hardly touched at all by what seems to be the most interesting and promising criticism of the orthodox system—viz., the 'Theory of Political Economy,' enunciated by Professor Jevons (first edition 1871, second edition 1879). All sciences, says this writer, are either logical or mathematical. All those which involve the ideas of quantity and comparative magnitude are necessarily of the latter order. It is not necessary that a science be exact in order to be

mathematical. On the contrary, in all the physical sciences, even in astronomy, there is more or less inexactitude in the actual conditions of every problem as contrasted with its ideal or theoretical statement—*e.g.*, in astronomical calculations the earth is treated as a perfectly smooth globe, &c., &c. Accordingly, Professor Jevons treats political economy mathematically—as a calculus of pleasure and pain. “The nature of wealth, value, &c., are explained by the consideration of indefinitely small amounts of pleasure and pain, just as the theory of statics is made to rest upon the equality of indefinitely small amounts of energy.”

The objection to this theory is that it supplies no independent standard whereby to measure the magnitudes of the quantities with which it deals.

The existence of such a standard, as we shall see later on, is an essential prerequisite to scientific knowledge. It is only by such means that we can distinguish knowledge from feeling, and there can be no science until the subjective sen-

sational element of feeling is eliminated. Professor Jevons indeed disclaims any attempt to compare the relative intensity of some similar sensation in two or more different individuals. (That certainly is not so much an impossibility as an unthinkable absurdity.) He measures the strength of feelings by their overt result upon our actions. Even thus, however, we have no objective standard wherewith to compare the phenomena we are studying independently of individual feelings and peculiarities. Jevons thus, whilst employing a pure mathematical calculus, derives no assistance from the ascertained laws of physics and dynamics. His system is mainly a theory of exchange and exchange value depending upon utility, which, as he understands it (p. 47), is by converse necessity no intrinsic or inherent quality, but only a circumstance of things.

His speculation, therefore, neither does nor could throw much light on the science of the *production* of wealth, dealing, as at least that

branch of economy must do, with objective physical facts. He indeed acknowledges his belief that "dynamical branches of the science of economy may remain to be developed, on the consideration of which I have not at all entered."

"Social speculation," says a recent writer (J. K. Inghram, LL.D., in article "Political Economy" in 'Encyclopædia Britannica,' ninth edition), "and economic research as one branch of it is, both through its philosophic method and through its doctrine, under the influence of those simpler sciences which in the order of development precede the social, especially of the sciences of organic nature;" and it is by an application of the laws examined and ascertained in the former that the more immediate progress of the latter is most likely to be promoted. "The radical vice," continues the writer just quoted—"the radical vice of this unscientific character of political economy seems to lie in the too individual and subjective aspect under which it

has been treated. Wealth having been conceived as what satisfies desires, the definitely determinable qualities possessed by some objects, of supplying physical energy and improving the physiological constitution, are left out of account. Everything is gauged by the standard of subjective notions and desires. All desires are viewed as equally legitimate, and all that satisfies our desires as equally wealth. Value being regarded as the result of a purely mental appreciation, the social value of things in the sense of their objective utility, which is often scientifically measurable, is passed over, and the ratio of exchange is exclusively considered."

There is much truth in these words. Without rashly departing from Mill's prudent principle, that the political economist should not undertake a comparative estimation of the different uses and desires from the standpoint of the *philosopher* or *moralist*, we shall still find it in the course of our investigation most profitable and essential to distinguish between the differences in the

qualities and kinds of wealth, arising from its varying *physical* functions and characteristics. We shall distinguish, first, between those classes of objects which satisfy the desires necessary to the maintenance of life, and those which correspond roughly to what are called luxuries. We shall find, as the writer above quoted suggests, that the former kind of wealth contains and consists in definite and measurable supplies of physical energy, capable not only of satisfying the fundamental desires incident to animal life, but of sustaining and augmenting the productive process itself—capabilities quite absent from the wealth which consists in objects whose mere possession or contemplation satisfies a wish or calls a fresh pleasure into existence. We shall find, too, as we proceed in our inquiry, that the scientific principles which we shall endeavour to apply to the doctrine of production will suggest to us a principle by which to arrive at a scientific standard or measure of value, at least of value in use; such a standard

as Mill pronounces to be not only unattainable, but hardly conceivable, but which, as is indicated in the above-quoted passage, would form a more secure and scientific basis for the measurement of the phenomena of the production of wealth than can ever be derived from considerations of exchange value, based upon the varying proportions in which different objects gratify the desires and minister to the pleasures of the individual.

The ascertainment and establishment of standards with which our judgments may be compared, and the accuracy of our knowledge tested, unadulterated by feeling or sensation, is the great secret and prerequisite of all true scientific progress. We are all familiar with the experiment of plunging the right hand into a vessel of cold water, and the left into a vessel of warm, and then plunging both simultaneously into a vessel of tepid water, when the tepid water feels warm to the one hand and cold to the other. It was only when the thermometer enabled men to test

the accuracy of their knowledge of heat-phenomena, independently of their own misleading feelings and sensations, that a scientific study of these phenomena became a possibility; and only when an equally scientific standard for the measurement and estimation of the value or amount of wealth has been discovered and employed, can the phenomena of the production of wealth be arranged into a genuinely scientific system.

All science is knowledge purified of feeling, and is advanced and indeed rendered possible only by the discovery and employment of such standards. Archimedes's specific gravity is just an example of such a standard. It is in the same way that the sun and moon on a large scale, and the pendulum on a small scale, enable us to have a knowledge of time. To estimate wealth by the pleasure it excites, and labour by the fatigue it induces, as economists have hitherto done, is of equal scientific value as, and no more than, if we were still to estimate duration by the fluctuating intensity of our feelings of weariness and

tedium. Defective as it seems to the theorist, and in truth is, money is a more scientific standard of value than any purely subjective criterion, and the true rationale of the function of money is not merely that it is more convenient than barter, or, as economists say, that it forms a convenient medium of exchange, but that it constitutes an objective test or standard of value, however imperfect.¹ The balance and its weights, which are as essential to exchange as money is, are another instance of the principle, which is simply that involved in Euclid's famous axiom: Things which are equal to the same thing are equal to one another.

Professor De Morgan, quoted by Jevons (p. 10), says, "As to some magnitudes, the clear idea of measurement comes soon, in the case of length for example." And he goes on to show that it is more obscure in the case of weight. "Had it not been," he continues, "for the simple

¹ See 'Money,' by Professor Nicholson, Part I., chap. ii.

contrivance of the balance, which we are well assured (how, it matters not here) enables us to poise equal weights against one another, . . . we might not to this day have had clearer ideas on the subject of weight as a magnitude, than we have of those of talent, prudence, or self-denial looked at in the same light."

We may conclude this digression by remarking that the principle of the balance was doubtless first proved, as the accuracy of such an instrument would still be tested, by reversing the conditions. If two bodies balance in the scales, and if on being exchanged they still do so, the balance is true. This seems to be the ultimate principle of all verification, of all testing of truth, both in things material, and in things moral and political. It is exemplified in the adjustment of a transit instrument or the analysis of a salt; it is embodied in the golden rule of all moral judgments: Whatsoever ye would that men should do to you, do ye even so to them. Justice is truly symbolised by a pair of scales,

and is really administered upon the same principle which regulates their employment.

II.

Wealth has been defined by Mill (vol. i. p. 8), as everything which serves any human purpose, and which nature does not afford gratuitously. In the main, this definition has been adopted by his successors.

Now, human purposes may be divided into two great classes, and wealth is accordingly susceptible of a similar division, according as it subserves the one or the other of these two classes. Firstly, there are the things which subserve the maintenance of animal life; secondly, there are the remainder, which gratify all other human wishes. Food, clothing, shelter, mainly subserve the first; jewels, pictures, art, and ornament of all kinds mainly the second. It is not usual, indeed, that a particular article can be wholly classed in one division or the other. Clothes, for instance, are

generally made to combine a certain subservience to both. But the distinction between the two classes is clear, and universally recognised. Use, and, as opposed to it, pleasure, are the terms sometimes employed to express it. In economics, however, as understood at least by Mill and his school (as also by Professor Jevons), use means both. Says Mill, vol. i. p. 538: "Political economy has nothing to do with the comparative estimation of different uses in the judgment of a philosopher or a moralist. The use of a thing in political economy means its capacity to satisfy a desire, to serve a purpose. Diamonds have this capacity in a high degree."

Nevertheless, and although objects of both kinds are included under the term wealth, it will be found undesirable, even in political economy, to overlook so important a distinction. As we shall see later on, the first class not only subserve the desire to maintain animal life, they subserve also, and to some extent simultaneously, to maintain a further effort of production. When

so employed, they constitute what the economist terms capital, and when viewed in this light, the distinction between them and objects of the second class (which fulfil their end in gratifying some human desire not essential to the maintenance of animal life) has been clearly recognised by economists. Marshall, 'Economics of Industry,' chap. iii. § 1: "Many things are sometimes used for business, therefore as capital, and sometimes for pleasure, and therefore not as capital. A French peasant's cart is used as capital in the field, but not as capital when it carries him and his family for a jaunt or a holiday. Again, it is not always clear to what extent a doctor's house or his carriage should be regarded as capital required for his business."

Several important distinctions between the two classes of wealth were pointed out by Adam Smith.

In Book I. chap. xi. part 2, he points out that desires for the first class—necessaries—are, generally speaking, limited, those for the second class illimitable.

In his Digression on the value of silver he remarks upon another distinction. "When we are in want of necessities we must part with all superfluities, of which the value, as it rises in times of opulence and prosperity, so it sinks in times of poverty and distress. It is otherwise with necessities. Their real price rises in times of poverty and distress, and sinks in times of opulence and prosperity, which are always times of great abundance"—*i.e.*, of necessities—"for they could not otherwise be times of opulence and prosperity."

Again, Book II. chap. i., Smith points out another distinction. He divides all stock into—(1) stock reserved for immediate consumption; and (2) and (3), fixed and circulating capital. The former he distinguished from the other two in respect that it yields no profit. (Of course the stock reserved for the immediate consumption of productive labourers is circulating capital, and should not be included under his first head.) The same distinction is seen in an often-quoted

passage in chap. ii. Speaking of the gold which any country may send abroad, he says: "If they employ it in purchasing foreign goods for home consumption, they may either, first, purchase such goods as are likely to be consumed by idle people who produce nothing, such as foreign wines, foreign silks, &c.; or, secondly, they may purchase an additional stock of materials, tools, and provisions, in order to maintain and employ an additional number of industrious people, who reproduce with a profit the value of their annual consumption. So far as it is employed in the first way, it promotes prodigality, increases expense and consumption, without increasing production. . . . So far as it is employed in the second way, it promotes industry; and though it increases the consumption of the society, it provides a permanent fund for supporting that consumption, the people who consume reproducing with a profit the whole value of their annual consumption." Most economists, however, although they would doubtless admit that it is only

to a limited extent that things can be transferred from one class to the other, still speak as if the division was the result of a purely voluntary determination. We shall see later on, how it corresponds to and apparently depends on certain objective physical laws.

III.

Now, in the production of wealth two things are requisite, according to the political economists—namely, LABOUR and APPROPRIATE NATURAL AGENTS (Mill, vol. i. p. 29). Both these are subjects of investigation by the student of physical science, and our object now is to bring to bear on the doctrines of political economy certain definitely and mathematically ascertained scientific facts, tending to throw light on the functions which they respectively perform in the process of production.

“Labour,” says Mill, “is either bodily or mental, or, to express the distinction more comprehen-

sively, either muscular or nervous; and it is necessary to include in the idea not solely the exertion itself, but all feelings of a disagreeable kind” (why not also of an agreeable kind?), “all bodily inconvenience or mental annoyance, connected with the employment of one’s thoughts or muscles, or both, in a particular occupation.”

Labour, then, as the term is understood by Mill, is of two kinds: labour physical, or work, as we commonly understand it; and what is usually described as thought, calculation—in a word, intelligence in action. In actual fact the two kinds of labour are generally combined in each occupation; but this would not be a sufficient reason for including them under one name, unless their functions in the production of wealth were similar. We shall hope to show that these functions are very different, and that the principles of political economy are rendered much clearer when this difference is recognised and given effect to. And this, we may add, we are entitled to insist in, whatever may be our views on the meta-

physical question as to the reality or ultimate nature of thought. All thought, all mental labour, may be accompanied by a minute change in the molecules of the brain, just as physical labour may involve a change in some other portions of the organism; but if the function of thought, if the result produced by its employment, is different from what it is in the case of muscular labour, we are entitled—nay, we are bound, so far as political economy is concerned—to recognise and give due weight to the distinction.

Indeed, so far, this distinction is recognised by Mill. "Labour, then, in the physical world," he says, "is always and solely employed in PUTTING OBJECTS IN MOTION; the properties of matter, the laws of nature, do the rest. The skill and ingenuity of human beings are chiefly exercised in DISCOVERING MOVEMENTS, practicable by their powers, and capable of bringing about the effects they desire." And he goes on to show that, however much the two kinds of labour may be united in the case of human beings, it is quite possible

and frequent, and often advantageous, to employ agents, such as beasts of burden, windmills, and suchlike, wherein mental labour is absent, and physical labour is in operation alone.

How often even this amount of distinction is subsequently forgotten and overlooked by Mill we shall see later on, although a certain growing tendency to recognise it is observable in more recent writers. For example, Professor Marshall, after treating of supply of unskilled labour and supply of skilled labour, devotes a third chapter to supply of business power; a chapter for which there is really no counterpart in the earlier works—such as Mill's 'Principles.' Apparently, however, he would still class the whole three under the general name labour. See, for example, chap. ii. sect. 2, where he distinctly says: "As civilisation increases, the relative importance of mental to manual labour changes. Every year mental labour becomes more important and manual labour less important."

In the meantime we desire to lay stress on

Mill's recognition of the fact that mental labour,—thought, intelligence in action,—is something entirely different from the minute cerebral molecular change, accompanied by a feeling of fatigue and a small evolution of heat, which may possibly be the physiological concomitants or correlatives of such mental labour. We quite admit that the fatigue resulting from a period of thinking may be as great as, or greater than, the fatigue resulting from a period of physical labour; but just as the exertion involved in physical labour and the changed position of certain material bodies, which may be its overt result, are quite distinct from the fatigue which accompanies such an exertion, so we must admit that the practical result of the thought and calculation engaged in by men is entirely different from the evolution of a small amount of heat or some other molecular change, the very existence of which was only recognised within comparatively recent years, or from the fatigue which of course has been recognised at all times. The calculation, invention, or

solved problem, which is the result of a man's thoughts, is entirely different and distinct from either of these.

IV.

Now labour, or at least work, has also been the subject of a great amount of investigation for a number of years past as a matter of physical science, and the natural philosopher has supplied us with a definition which is well worthy of our attention. He defines work as the changing of the position of bodies against force. Clerk Maxwell, in 'Matter and Motion,' p. 59, gives the full definition as follows: "Work is the act of producing a change of configuration in a system, in opposition to a force which resists that change." Work, then, in the scientific sense, exactly corresponds to the bodily labour of the political economist; because it is impossible to put in motion any material body presently at rest without encountering and overcoming some force; nor is it possible to alter the direction or speed

of a moving body except on the same condition (Newton's First Law). So that the scientific definition of work describes the same class of operations as are described by the economist's expression "bodily labour." But the additional words "against force" contained in the scientific definition are nevertheless well worthy of our attention.

For (1) this phrase clearly distinguishes bodily labour from mental labour. Although a minute change of position of certain small particles effected against certain molecular forces may, as we have seen, be the accompaniment of a thought or intellectual act, the thought itself is something different, and has altogether different results. (2) The words "against force" point out a principle upon which natural philosophers are now able to correlate the theory of work with the whole body of scientific doctrine, with the whole system, in fact, of our knowledge of natural agents.

By a few excerpts from standard scientific

treatises we shall proceed briefly to explain and illustrate the modern scientific doctrine of labour or work, including its relation to those natural agents which constitute, as Mill says, the other factor in the process of production of wealth.

"We live in a world of work," says the late Professor Balfour Stewart ('Elementary Lessons in Physics,' p. 98), "of work from which we cannot possibly escape, and those of us who do not require to work in order to eat, must yet in some sense perform work in order to live. Gradually and by very slow steps the true nature of work came to be understood. It was seen, for instance, that it involved a much less expenditure of energy (energy means simply the power of doing work) for a man to carry a pound weight along a level road, than to carry it an equal distance up to the top of a mountain.

"It is not improbable that considerations of this kind may have led to a NUMERICAL ESTIMATE OF WORK.

"Thus, if a kilogramme be raised one metre high against the force of gravity we may call it one unit of work; in which case two kilogrammes raised one metre high, or one kilogramme raised two metres high, will represent two units—and so on. We have therefore only to multiply the number of kilogrammes by the vertical height in metres to which they are raised, and the product will represent the work done against gravity.

"The force of gravity, being very nearly constant and always in action, is a very convenient force to measure work by, and it is generally made use of for this purpose. We shall therefore take as a unit of work the kilogrammetre, or the work represented by one kilogramme raised one metre high against the force of gravity at the earth's surface."

"Having thus defined work," continues the same writer, "the next point is to connect it with momentum." This ratio he then proceeds to ascertain numerically, and arrives at the

general rule that the work which can be accomplished by a moving body is proportional to the square of its velocity, and also is directly proportional to its mass.

He then proceeds to the exposition of the great scientific doctrine of energy—the power of doing work—for that is the name now given by natural philosophers to the physical entity in virtue of whose agency all work is done, all physical changes take place. In sections 101, 102 of chapter iii. (the whole of which we commend to the reader unfamiliar with the conception of energy), he takes the case of a stone shot upwards with great velocity, which may be said to have a great deal of energy—*i.e.*, power of doing work—because it effects, or we should rather say, perhaps, undergoes, a change of position in opposition to the force of gravity. But the stone gradually comes to a standstill; all its energy being employed in raising it. Suppose, just as it stops and is about to fall, it is caught and lodged on the top of a house. What has

become of its energy? The stone is at rest. Is its energy all consumed and utterly destroyed? Not so. The energy is still in existence, and we can at any moment again make this energy manifest and employ it, by dropping the stone down, when it will acquire, as its velocity gradually increases, a power of doing work proportionate to that which it possessed when first fired off, and which might be employed in turning a wheel, driving a pile, or in a hundred other ways.

Now, the energy manifested in a body in actual motion is called kinetic energy, that in a body at rest is called potential energy, or energy of position, which occurs when any body is in a position in which it is under the attraction of some natural force.

"There are therefore," continues Professor B. Stewart, "two kinds of energy, which are continually being changed into one another, and these are the energy of actual motion and energy of position. As an example of the first kind,

we have a stone projected vertically upwards, or indeed projected with velocity in any direction, for it is the velocity which is material, not the direction. Again, as an instance of the second kind of energy, we have a stone on the top of a house, or any substance, such as a head of water, occupying a position of advantage with respect to gravity or any other force. . . .

"But there are other forces besides gravity, and one of the most active of these is chemical affinity. Thus, for instance, an atom of oxygen has a very strong attraction for one of carbon, and although very minute, within certain short limits they attract one another with great intensity, just as the earth and the stone in the above illustration did under the force of gravity. When separated, they are endowed with so much potential energy, just as the stone was at the top of the house. Thus, by having a large quantity of oxygen and a large quantity of carbon in separate states, we are in possession of a large store of energy of position. When these rush

together, as the stone and earth did, this is transformed into kinetic energy. This is what takes place when we burn coal. The result is, first, that great heat is produced; and when we utilise this heat to drive an engine, we are utilising energy just as much as when we utilise a waterfall or a weight."

Professor Stewart then proceeds to show that all physical agents with which we are acquainted are forms of energy; all are exchangeable into each other; it is in virtue of these changes that work is done, that combustion and all other physical processes are maintained, and that the whole phenomena of the physical universe arise.

"Energy," say the authors of the 'Unseen Universe' (second edition, p. 104), "is of use to us solely because it is constantly being transformed. When the sluice is shut or the fire put out the machinery stops; when a man cannot digest his food he breaks down altogether. Coal in itself, except on account of an occasional fossil it may contain, or its still somewhat uncertain

mode of formation, or, to take a lower point of view, as a material for ornament, is a very useless thing indeed: its grand value consists in its chemical affinity, in virtue of which it possesses great potential energy (as regards the oxygen of the air), which can be very easily transformed into its equivalent in heat. 'Keep your powder dry' is merely one way of saying, 'Preserve the ready transformability of your energy.' In fact, if we think for a moment over what has just been said, to the effect that the only real things in the physical universe are matter and energy, and that of these matter is simply passive, it is obvious that all the physical changes which take place, including those which are inseparably associated with the thoughts as well as with the actions of living beings, are merely transformations of energy."

On the same subject we quote as follows from 'Recent Advances in Physical Science,' by Professor P. G. Tait, p. 17:—

"It is only within comparatively recent years

that it has been generally recognised that there is something else in the physical universe which possesses to the full as high a claim to objective reality as matter possesses, though it is by no means so tangible, and therefore the conception of it was longer in forcing itself upon the human mind. The so-called imponderables, things of old supposed to be matter, such as heat and light, &c., are now known by the purely experimental, and therefore the only safe method, to be but varieties of what we call energy,—something which, though not matter, has as much claim to recognition on account of its objective existence as any portion of matter. The grand principle of conservation of energy, which asserts that no portion of energy can be put out of existence, and that no amount of energy can be brought into existence by any power at our command, is simply a statement of the invariability of the quantity of energy in the universe—a companion statement to that of the invariability of the quantity of matter.

“The laws of energy differ from those of matter in one most important respect, so far at least as we yet know by experiment. Matter cannot be transmuted from one kind to another. . . . The great characteristic of energy, on the other hand, is that in general we can readily transform it (in fact it is of use to us solely because it can be transformed), but in all its transformations the quantity present remains the same.” The writer then proceeds to describe the two kinds of energy, potential and kinetic (as has already been explained in the passages quoted from Stewart), giving the same instance of potential energy and adding: “Other examples of it are to be found in a wound-up spring or weight, as in a clock, a bent bow, or in gunpowder, and various others might be easily mentioned. *Perhaps the most striking of all instances that we can give is that of the food of animals, including as one of the principal constituents the oxygen of the atmosphere.*” He then goes on:—

"We contemplate, therefore, with reference to energy, its conservation, which merely asserts its objective reality, its transformations, which render it indispensable to the existence of life and the physical changes in the universe; but it has in addition another and even more curious property. We have seen that change is essential to the existence of phenomena such as we observe, and that this change may take place, it is necessary that there should be constant transformations of energy. But some forms of energy are more capable of being transformed than others, and every time that a transformation takes place, there is always a tendency to pass, at least in part, from a higher or more easily transformable to a lower or less easily transformable form,"—and the writer proceeds to describe the principle of the dissipation of energy.

"It was," he further says—"it was a grand step in science which showed that just as the consumption of fuel is necessary to the working of a steam-engine, or to the steady light of a

candle, so the living engine requires food to supply its expenditure in the forms of muscular work and animal heat,"—p. 23.

Again (p. 137), "There is, of course, the same amount of energy in a given quantity of heat in whatever body and at whatever temperature you have it, for a quantity of heat, whatever its temperature, represents its equivalent of work. But though there is a definite mechanical equivalent for so much heat, there are vast variations in its utility under different circumstances. If you have heat in a very hot body, you can get a great deal of its *value* out of it. On the contrary, if you have it in a comparatively cold body, you can get very little out of it; and therefore we are led to speak of the availability of an amount of heat-energy. Availability of energy simply means its capability of being transferred into something more useful—*i.e.*, of being raised higher in the scale of energy—and depends, in the case of heat, entirely upon the temperature at which we have it."

"Energy is thus," once more to quote Professor Balfour Stewart, "of different qualities, mechanical energy being the best, and universal heat the worst." All are, however, transformable into each other, and all may be included in one or other of the two classes, potential and kinetic. And in regard to the former of these, it is important to remark, as is well pointed out by Professor Garnett in his article on Energy in the 'Encyclopædia Britannica,' that it is no mere expectancy or possibility; it is equally real and actual with kinetic energy; it is merely not manifested in the particular form of phenomena known as bodies in motion.

We are not here directly concerned in the interesting accounts which the natural philosophers give of the main sources of the energy available for human needs. The great source of all is the sun. But in the course of Professor Balfour Stewart's account of this subject occurs a passage with which we shall conclude our quotations. It shows admirably how both the vital process

and the power of working depend on the supplies of energy which our system receives.

"We all of us possess a certain amount of energy in our systems, a certain capacity for doing work. By an effort of his muscles the blacksmith imparts a formidable velocity to the massive hammer which he wields. Now, what is consumed in order to produce this? We reply, the tissues of his body are consumed. If he continues working for a long time, he will wear out those tissues, and nature will call for food and rest: for the former, in order to procure the materials out of which new and energetic tissues may be constructed; for the latter, in order to furnish time and leisure for repairing the waste. Ultimately, therefore, the energy of the man is derived from the food which he eats; and if he works much, that is to say, spends a great deal of energy, he will require to eat more than if he hardly works at all. Hence it is well understood that the diet of a man sentenced to imprisonment with hard labour must be more generous

than that of one who is merely imprisoned; and that the allowance of food to a soldier in time of war must be greater than in time of peace. . . . In fact, food is to the animal what fuel is to the engine. . . . It is, in truth, the combustion of the food that furnishes our frames with energy; and there is no food capable of nourishing our bodies which, if well dried, is not also capable of being burned in the air."

We have quoted thus fully from one or two of the standard elementary scientific works upon this important subject, not with the hope that the extracts given will suffice to supply to every reader the clear, accurate, and definite scientific conceptions which are essential to the proper understanding of this subject, but simply in order that our essay may contain within its own limits an authoritative summary of the physical principles which we are anxious to apply in the region of economical science.

This doctrine of energy, it is necessary to remember, recent though it be, and strange still to

many minds, is no mere curious inquiry or *diletante* excursion into some by-path of science. It is really the whole system and philosophy of the physical and material universe, and of the changes (non-vital), processes, and phenomena which are presented to the consciousness of man. No theory of labour or work, no philosophy of the production of these things which sustain and gratify human life, can rest upon any accurate and scientific basis, unless it is founded upon the clear and accurate comprehension of these fundamental physical truths.

V.

The doing of work, then, requires and presupposes the existence of a certain quantity of energy in an available form, and the doing of work is a transmutation of this energy into another and less available form.

The mere existence of the animal involves a process of combustion, and to maintain this pro-

cess its supply of fuel or food (whose value consists entirely in the potential energy due to its chemical affinity for oxygen) must constantly be replenished. The food *maintains life* by transmutation of its potential energy into the lower form of heat. Part of the energy of the food is also available, so far as needed, *to do work* by being employed in overcoming force, and the individual so directs this work as to render new supplies of food-energy accessible for his consumption.¹ Life, therefore, is a perpetual cycle, and work is a constant and necessary consumption of energy performed in order to replenish the supplies of energy needed for the maintenance of the great process of combustion essential to the support of life, as well as for the maintenance of the working process itself.

Life as a physical function is maintained by constant supplies of potential energy, ready to

¹ Combustion and bodily movement are thus the two great physical functions or processes essential to the maintenance of life, and for and in the support of which the "necessaries" of life are consumed.

transmute and in fact transmuting itself into heat and other lower forms, and the object of labour is simply, in the first place, to be constantly bringing supplies of this energy into communication with our organism, and thus satisfying our desire to live,—a desire strengthened and stimulated by the operation of the special appetites of hunger and thirst and the love of warmth; and secondly, when this primary object has been attained, labour is devoted to gratifying other secondary desires by bringing other objects within the power and consciousness of the individual, and so appeasing those other needs and wishes which arise when the primary cravings of hunger and thirst have been satisfied and supplied.

Wealth, then, of the *first* class, is essentially either (*a*) what the natural philosopher knows as potential energy in certain of its forms, or else (*b*) whatever increases or economises the supply of this potential energy in the individual. Clothing, for example, by maintaining the animal heat and protecting from injury the

animal organism, renders a less quantity of the potential energy of food necessary to maintain the vital process of combustion, and protects and preserves the supply. It is thus entitled to be regarded as wealth quite as much as food itself. We have already seen that those forms of wealth which thus directly or indirectly subserve the maintenance of life are commonly described as necessities, those which subserve the secondary desires of life being described as luxuries: and it must be observed that a thing comes under the first class not only if it cannot be done without, as might be true perhaps of milk; but in every case, if it be in fact employed to maintain life, even although, as in the case, for example, of meat, some other thing might in substitution be utilised for the same purpose.

Now it is particularly to be observed, and has been already indicated, that whilst these necessities maintain and renew the animal process of combustion in which physiologically life consists, they likewise serve to supply and renovate

the consumption caused by the labour which is constantly required to make available to the individual the requisite quantities not only of those necessities themselves, but also of such luxuries as he may wish and be able to obtain. The acquisition of wealth, therefore, of *both* kinds, is dependent on the maintenance of the supply of potential energy, and its equivalents in the shape of food, clothing, shelter, &c., in fact, of necessities. But a similar statement is not true with regard to luxuries. It is essential that the supply of food shall be kept up, if the supply of diamonds is to be maintained: it is by no means essential to the continued supply of food that diamonds shall continue available or obtainable to any extent at all. Of course, whilst wealth of the first and primary class is thus seen to be the very same identical entity as that known to the natural philosopher as potential energy, it does not follow and is not true that all potential energy is wealth; and, as we have seen, wealth of the

second class is not necessarily or always potential energy. Still, all wealth of both classes is always ultimately dependent on the supply of potential energy being maintained.

We see now clearly the true nature of the relation of labour to wealth. In the first place, labour is undoubtedly essential to the acquisition of wealth. This is indeed a truism, if once we concede the soundness of the definition of wealth with which we started. Were wealth merely defined as everything which satisfies a human desire, or as everything which helps to maintain life—both perfectly intelligible ideas—it would include the air we breathe and the sunlight, which perform indispensable functions in maintaining life, and are the reservoirs from which the world's supply of potential energy is replenished. Such a definition would exclude all reference to labour, and would identify wealth with everything which possesses what economists call value in use. But the idea of wealth, as is well pointed out by Adam Smith, is originally derived from

man's propensity to exchange. Now, whilst its value, in use, depends principally on the amount of potential energy which a thing supplies for the support of life, its value, in exchange, depends upon the amount of such energy consumed in supporting the labour employed in acquiring possession of it. Hence it is (see 'Wealth of Nations,' Book I. chap. v. para. 2) that the term wealth being confined to those desire-gratifying objects which cannot be procured without labour, we must acknowledge the self-evident verity of the maxim that labour is essential to the production of wealth. Yet, as is often the case, this proposition, which now appears almost truistic, and the importance of which to the modern mind has been in our age emphasised by the vast developments of industry and the extraordinary extension of physical knowledge, and of what we may call practical dynamics, was only first clearly recognised and enunciated at the end of last century by Adam Smith.

But although labour is essential to the ac-

quisition of wealth, it is most false and inaccurate to say, as is so very frequently done, that labour is the only source of wealth.¹ Wealth, fundamentally and in the main, consists in potential energy: the mere particles of matter in themselves have no value as wealth, their value consists entirely in their local position or chemical or molecular arrangement, and in the energy or power of doing work which they possess in virtue of such arrangement or position, with reference to the forces of nature—that is, once more, in their potential energy. Now labour itself is dependent upon the supply of, and is itself entirely a consumption—although, as we shall understand shortly, possibly a profitable consumption, still a *consumption*—of potential energy.

It is important for our present argument that we should clearly understand that it can now be scientifically demonstrated, and even quanti-

¹ See M'Culloch's Introduction to 'Wealth of Nations,' p. xxxv, and note to p. xxxix.

fably calculated and proved, that labour, physical or manual, is a consumption of wealth. The fact is indeed so fundamental an element of economic theory that it could not fail to be recognised at almost every step by all leading writers on the subject. Yet, as Mill says (p. 78), speaking of another proposition, "a truth may be so obvious as to be taken for granted in many common forms of speech; but to see a truth occasionally is one thing—to recognise it habitually, and admit no proposition inconsistent with it, is another;" and so it is in the present case.

For example, Mill himself, although quite ignorant of the principles of the doctrine of energy, with his remarkable perception and penetration, on several occasions practically announces the truth of this doctrine. It is, for instance, really involved in the proposition, so clearly maintained by him, that all labour is limited by capital, and that there can be no labour unless in proportion as there is a pre-existing fund of capital to support it, and which it consumes.

All such admissions were, however, rendered of little value by the want of any definite scientific basis to sustain them, and by their total omission to distinguish between labour physical—work in the scientific sense—and labour mental, in regard to which latter, for example, the proposition above mentioned as to its limitation by capital is only true with certain important qualifications.

VI.

But if labour is truly a consumption of wealth, how, it will be asked, can wealth ever be accumulated and increased? If the process is a mere continuous cycle such as we have described, how is capital collected and profit made? To these important questions also the doctrine of energy supplies an answer at once simple, lucid, and complete.

We cannot, as we have seen, create any quantity of energy. All the human labourer

does is to effect the transference of energy from one place or portion of matter to another, and so render it more available for the necessities of life. In doing this, his energy is mainly employed in overcoming the forces of gravitation, and to some extent cohesion, which forces form the main obstacle to the changing of the position of material bodies; but then there are other forms of energy, such as that due to the force of chemical affinity, which are far more powerful in proportion to the mass of the body with which they are associated than the energy due either to gravitation or cohesion. For example, the explosive energy of an ounce of gunpowder, due to the chemical arrangement of its particles, is an immeasurably more powerful agent than the potential energy which it possesses in virtue of its weight, at least at any ordinary height above the ground. Or, to take another instance more fully illustrative of the truth. A very considerable item of human wealth at present consists in coal. The value of coal, what renders it wealth,

is the potential energy possessed by its particles in virtue of their chemical constitution, which fits it to support combustion, and thereby develop vast quantities of the form of energy known as heat. The energy which a piece of coal possesses of this kind, may be greater far than the amount consumed in overcoming its weight, and moving it to the necessary distance. Marshall ('Economics of Industry,' Book I. chap. ii. p. 2), gives a numerical ratio. One lb. of coal, he says, will raise 100 lb. 1200 feet high.¹ Suppose a coal-mine to be fitted up in such a way that the whole work of excavating, raising, and delivering the coal could be performed by machinery without human labour. The coal expended in driving the steam-engine which worked the machinery of this mine might be far less than the whole coal raised, and that simply because the potential energy of chemical affinity contained in the smaller portion of coal

¹ For other instances, see 'Subjects of Social Welfare,' by Sir Lyon Playfair, p. 134 *et passim*.

consumed was greater than the whole forces of cohesion and gravitation requiring to be overcome in moving the entire mass excavated to the necessary place. It is out of the surplus that profit is accumulated. It is in virtue of this surplus that a production of wealth takes place. The wealth consists in the surplus potential energy of the coal, rendered available for human uses by the expenditure of the labour of raising it, &c., over and above that amount of potential energy so expended. Of course the potential energy so expended is usually partly expended in sustaining human labour; but this human labour is just consumption of another kind of potential energy, not essentially different from that of coal—namely, the energy of the food consumed by the labourers—and the total potential energy expended on the labour of collecting the coal must be less than that rendered available for use, or there is no production of wealth in the operation.

It is the same with the case of agriculture.

The sum of the potential energies expended in the rearing of the crops must be less than the amount of potential energy rendered available for human uses by the operations of the farmer and his assistants, if there is to be any production of wealth from the labour so expended. In the case of the coal, the labour is expended in transferring the body in which the potential energy resides to a position where its energy may be made available for human uses; in the case of agriculture, the labour consists, at least at first, in so arranging the particles of matter that a transference of energy—the energy resident in the sun's rays—shall take place from these rays to the particles which their agency builds up into the plant, in which the energy, in the form of potential energy of chemical separation, comes to reside. And it is in one or other of these two ways that all labour is exerted in the production of wealth in its primary form.

Furthermore, from this explanation we are enabled to understand not only how wealth is

produced and profit made, but, what receives very little elucidation in any treatise on political economy with which we are acquainted—namely, how, very often, labour may be partly or entirely wasted, and loss take the place of profit. That this is so is a fact so universal and common that it is of course recognised by John Stuart Mill, as when he states that (p. 63) “even productive labour may be wasted where more is expended than really conduces to production;” and he goes on to illustrate this truth by several very simple examples. All labour being, as we have seen, a consumption of potential energy, it can only result in a production of wealth if in some of the ways above indicated, in exchange for the potential energy consumed by the labourer, another and larger quantity is made available to human uses. If, for example, in the case of a coal-mine, above quoted, it were found that the coal was of such inferior chemical constitution that its particles did not possess almost any potential energy—in plain words, that it would hardly burn; or

if the extraordinary depth of the coal and the hardness of the strata which had to be penetrated before it was reached involved the expenditure of a greater amount of potential energy than was present in the coal itself; or if a failure of the sun's heat, or a flood, or bad soil, so impeded the growth of the farmer's corn that the amount of potential energy which it all contained when reaped was less than that consumed by the farmer and his assistants in the agricultural process,—then in all of these cases there would be no production of wealth at all as the result of the operation. The amount of potential energy consumed by the labour being greater than that recovered and rendered available, there would, on the whole, be a consumption of potential energy, and a waste of labour and a loss of wealth.

All this is of course illustrated with the utmost frequency in our everyday experience. The various objects which constitute wealth have in the mercantile world their value set down in money, and these values are roughly

equivalent to the amount of potential energy which they possess. Thus it is that a balance-sheet and a profit and loss account are the rough and ready methods of commerce to determine whether a production of wealth has in any particular case taken place—*i.e.*, whether a larger amount of potential energy has been supplied than that consumed in the labour of supplying it.

We must therefore hold it proved—as a companion and equally important truth to the doctrine that labour is a necessary prerequisite to the production of wealth—that the mere expenditure of labour is actually a consumption, and in no sense necessarily a production or accumulation of wealth.

A man may spend hundreds of pounds, say, in the draining of marsh land, an operation subsidiary to rendering available for human uses the energy of the sun's rays shining upon the land in question, by facilitating its conversion into the potential energy resident in such crops as man can eat, instead of the equal

quantity of potential energy employed in sustaining the life of rushes and marsh weeds. But a single miscalculation of six inches in the taking of his levels may make the whole of his great drainage scheme abortive. There is here probably exactly the very same amount of labour expended, and in almost exactly the same way, as if his levels had been right; but instead of being productive it is all utterly wasted. It is all pure consumption of wealth, and does not add one single atom to the production of the world. What more conclusive evidence could there be that in the essential nature of labour itself there is really no such productive power or tendency to fructify into wealth as seems generally supposed to reside in it? To hear the ordinary orator or newspaper writer on these subjects (*e.g.*, Henry George's 'Social Problems,' p. 80, "Nature gives wealth to labour and to nothing but labour"), one would think that labour, by the very virtue of its inherent nature, seemed to beget or generate wealth as a

necessary consequence of its exertion. Nothing could be a greater delusion, nothing, it can be scientifically and mathematically demonstrated, could possibly be farther from the truth.

VII.

But the last illustration is serviceable as showing us very clearly what it is that distinguishes the productive from the unproductive employment of labour, and enables us to select and devote our energies to the former. That, we shall soon see, is the special function of intelligence, of thought or calculation, of that mental labour which we formerly saw grouped with and included by the political economist under the general name labour.

Even Adam Smith sometimes recognises this function of thought pretty clearly—*e.g.*, where he says: "The most important operations of agriculture seem intended not so much to increase, though they do that too, as to direct the

fertility (*i.e.*, the energy) of nature towards the production of the plants most profitable to man. A field overgrown with briars and brambles may frequently produce as great a quantity of vegetables as the best cultivated vineyard or corn-field," &c. Mill also recognises so far, though imperfectly, that the function of thought is different from that of physical labour. "Labour in the physical world," he says (p. 33), in a passage we have already referred to, "is always and solely employed in putting objects in motion; the properties of matter, the laws of nature, do the rest." And he goes on to say: "The skill and ingenuity of human beings are chiefly exercised in discovering movements practicable by their powers, and capable of bringing about the effects they desire." He thus clearly recognises a difference between the functions of labour and of thought in the process of production. But the distinction is of little practical value to him, for he is constantly mixing up physical and mental labour together. He is not, indeed, in

possession of the scientific definitions and data whereby labour proper can now, as we have seen, be distinguished and definitely measured by reference to the amount of force it overcomes.

The consumption of potential energy involved in the operations of thought is infinitesimal and inappreciable, beyond, indeed, the consumption of such energy involved in the maintenance of the animal life of the thinker, which is not greater in the case of the thinker than in the case of the labourer; and, on the other hand, that thought and ingenuity are employed in comparing and observing natural objects, and calculating and ascertaining in what cases the labour exerted in putting such objects in motion shall so result that an amount of potential energy shall be rendered available for use greater than the amount consumed in such exertions. In the savage state of man, and in the lower animals, the appetites and tastes naturally direct the animal energies to such movements as shall so far subserve these objects. An animal's

senses of taste and smell guide it so far as to what food it should seek to sustain life. But the progress of man, the advance of civilisation, are only possible when by the exercise of thought and reason and calculation and memory man devises such means as shall render more supplies of potential energy available to sustain life. In this way, and by being able to store up such supplies, it ceases to be necessary for him to devote his whole time to the procuring of the bare necessities of existence, and leisure for the further development of his mind becomes a possibility. This is the true meaning of the maxim that knowledge is power. Thus it is that man has gradually acquired his ever-increasing dominion over the material world.

The most elementary acts whereby life is sustained, the gathering and cooking food, the preparation of shelter and clothing, require, of course, intelligence. It is, indeed, this which enables man to select the "appropriate" natural agents suitable for his purposes. But the in-

fluence of intelligence upon the productiveness of labour becomes more and more marked, as agriculture and industry advance. Man is constantly discovering how to make plants and animals more capable of replenishing his supplies of potential energy. Take the example of manuring. It is by thought, calculation, and observation that man comes to see that by depositing certain materials in one place instead of in another, perhaps at no increased expenditure of labour, the potential energy derived from certain crops is largely augmented.

One most common way in which thought and ingenuity thus aid in the production of wealth is by taking advantage of the great natural energies which surround us—*e.g.*, by placing a water-wheel under a waterfall, whereby the vast quantities of energy in the falling water are rendered available for human uses. The same thing is illustrated in inventions such as that of the steam-engine and suchlike. The whole physical universe is simply a vast storehouse of energy,

continuously transmuting itself from one form to another; the skill and ingenuity of man intercept the mighty and multifarious stream at various points, and direct the energy into channels wherein its transmutations become serviceable to human uses, and wherein portions of it can be stored up in convenient and available forms for the maintenance of animal life.

It is thought, again, which determines before any operation is undertaken whether the result will be a profit or a loss. Before the prudent coalmaster sinks his mine he determines whether the quality—*i.e.*, the potential energy—of the coal is sufficiently great, and whether the labour necessary to be expended in raising it is sufficiently small to secure that the potential energy made available by the operation shall be greater than that expended. And it is the same with every other productive effort. Either (1) the thinker devises from his knowledge of nature some new arrangement of material bodies to be effected by human labour which shall render a

larger amount of potential energy available than hitherto—*e.g.*, when the chemist invents some new explosive possessing more potential energy than that previously in use, or invents some new manurial agent possessing greater potential energy of chemical separation than those previously used for the same purpose; or (2) the thinker devises what is called a labour-saving arrangement—*i.e.*, some new arrangement with reference to the objects to be moved by human labour in rendering some particular amount of potential energy available to man, whereby the amount expended in the act of labour is made less, and the surplus available as an addition to human wealth is correspondingly augmented—*e.g.*, by inventing a reaping-machine, to take the place of sickles; or, say, a new build of ship, which can be propelled through the water at a given speed with less expenditure of energy than before.¹

These are merely one or two illustrations of

¹ Watt's improvements on the steam-engine are good instances.

a principle of which, in truth, every agricultural and industrial operation, every effort of production made by man, is an example. All, counting every numerical operation, is an act of thought; every plan, design, pattern, everything which can be represented by a drawing, is another. Eliminate only these two forms of thought entirely from industrial operations, and you are instantly reduced to the conditions of savage life. The humblest dressmaker in cutting cloth, and the great engineer of a Brooklyn Bridge, must alike have a design, if the labour which they exert or direct is not to be a mere consumption of wealth and a dead loss.

The function, then, of thought in the process of production is entirely different and distinct from the function of labour. Both are necessary prerequisites to the accumulation of wealth. Neither, therefore, should quarrel with or despise the other. Both must act harmoniously together to bring about the desired result. At the same time, it should never be forgotten or

overlooked that the more thought and the less labour employed in rendering available any particular quantity of potential energy, the greater will be the amount of wealth produced. The labour is, in truth, a necessary deduction from the already accumulated store of potential energy; and the less that deduction is, the greater will be the amount of wealth when the operation is completed.

It is, perhaps, hardly necessary to point out that of course in one of two countries where a greater amount of labour is expended there is probably taking place a greater production of wealth. Supposing in two countries the methods of industry are the same, but that in the one there is double the amount of labour employed, there will be double the production of wealth. That is simply equivalent to saying that if some industrial operation which does result in a production of wealth be repeated twice, there will be a production of double the amount of wealth; it none the less follows that in each case the

labour employed represents a consumption of wealth.

It is equally obvious, and has been clearly pointed out by Mill and most others, that of course the potential energy or wealth consumed by labour in any operation must have been previously accumulated at some earlier time. You cannot by anticipation support the labour out of the potential energy which is to be made available as a result of its exertion, and it is only in virtue of the potential energy already available for man's requirements, without any long-sustained labour, that the processes of industry could ever have been started to work. The original occupations of man were those of the hunter and the fisher; and it was by these, and by the natural spontaneous fruits yielded without labour by the earth, that he must have sustained life till his first crops were reaped, and his first accumulations made. None the less is it true that the stock of wealth can only be increased if the deduction from the previously existing store involved in the expen-

diture of any quantity of labour is more than counterbalanced by the magnitude of the new supply which that labour has put in its place.

Of course the simplest occupations really involve the expenditure of some labour *before* the wealth is acquired. Mr Henry George ('Progress and Poverty,' vol. i. chap. 3), seems to think that such labour is not supported out of any previous accumulation of capital, and he argues that such illustrations prove that labour is never so supported. But the fact is, that even such labour is an expenditure or consumption of a store of potential energy by its transmutation into other forms at a given mathematical rate, and unless in so far as such potential energy has been accumulated and stored up in, or for the individual, no labour is possible to him. Ever since his mother's milk first gave him strength to make a noise in the world, Mr George's every physical effort has been supported and rendered possible by the existence of a stock of what is neither more nor less than capital.

Mr George's example of the piece of leather worked up into a pair of shoes affords a further illustration of our argument. The shoes, he says, are not drawn from capital, "either my capital or any one else's capital, but are brought into existence by the labour of which they are the wages, and in obtaining this pair of shoes as the wages of my labour, capital is not even momentarily lessened one iota. For, if we call in the idea of capital, my capital at the outset consists of the piece of leather, the thread, &c. As my labour goes on, value is steadily added, until, when my labour results in the finished shoes, I have my capital *plus* the difference in value between the material and the shoes. In obtaining this additional value—my wages—how is capital at any time drawn upon?"

Our foregoing argument enables us to answer Mr George's question. The shoemaker's capital included the potential energy stored up in his bodily tissues as well as the leather and the thread, and this potential energy *was* momen-

tarily and steadily lessened by his labour. The increased value of the finished shoe was necessary to compensate this deduction, and would, when paid, be so employed by the shoemaker. Nay, more, such value could only exist if the labour were under the guidance of intelligence, and were directed according to a rational and calculated design. Otherwise the finished shoe would be of even less value than the original leather. Suppose that the shoemaker, from want of "thought and calculation," made a mistake of a quarter of an inch in shaping his material, we fear even Mr George, if the shoe had been made for him, would hardly have been inclined to pay the labourer his wage, merely because he had expended the full amount of labour requisite in the manufacture of a shoe; and had the labourer quoted Mr George's own argument in support of his claim, Mr George would perhaps tell him that there was a place where the shoe pinched, both in his logic and in his leather.

VIII.

The important truth which we have thus imperfectly endeavoured to illustrate not only furnishes a much-needed corrective to many of the current popular delusions on the subject of labour and wealth, but it throws a flood of valuable light on almost every part of the whole science of political economy. The insight of J. S. Mill undoubtedly often anticipates and recognises many of the truths which are involved in it; but in ignorance, as he was, of the then scarcely developed doctrines of the theory of energy and the modern scientific view of the nature of work, he was without that unifying conception which, like the sun in the heavens, gives illumination and consistency to the whole science—he was not even possessed of the necessary terminology to express with practicable clearness many of the most important truths which are contained in this doctrine. Above all, he had no impersonal and scientific standard whereby to measure

and discriminate the operation of the different agents in production, and this renders comparatively valueless even those passages where temporarily he more or less correctly recognised their respective influences—as, *e.g.*, p. 245: “Whether they like it or not, men’s production will be limited by the amount of their previous accumulation; and that being given, it will be proportional to their energy, their skill, the perfection of their machinery, and their judicious use of the advantages of combined labour.” Even here the distinction between thought and labour is only acknowledged in an illustrative, indefinite, and unscientific way, and not so clearly as it has sometimes been recognised by others; as, for instance, by the disciples of the school of Communism styled Fourierism, who, according to Mill, p. 260, proposed to divide the wealth of the community between capital, labour, and talent—thus clearly acknowledging the distinct place occupied by intelligence as a productive agent, quite apart from labour altogether.

We do not propose by any means to apply in detail to all the various doctrines of political economy the truths which we have now deduced from the sphere of natural philosophy, but we should like to point out one or two of the more striking applications of this doctrine.

For example, there is the question of the distinction between labour that is productive and labour that is unproductive—for the economists have had to admit that there is some labour which is unproductive—from which it is a necessary inference that the mere exertion of labour is not in itself essentially and necessarily a productive process.

Mill discusses this subject in an interesting chapter (p. 55), explaining the conflicting views of the two schools, one of which refuses the term productive to any labour which does not result in the production of some material object, whilst the other protests against the stigma of unproductiveness being applied to any labour which is regarded as useful, which produces a benefit worth the cost.

Now production is a relative term. It has no meaning at all unless it be conjoined with the idea of what is produced. There can surely be no doubt that production in the mouth of an economist means production of wealth. See Mill's Introduction, where on the first page he states that political economy deals with the nature of wealth and the laws of its production and distribution. (See also Marshall, Book I. chap. i. p. 6.) He naturally, therefore, comes to the same conclusion in the chapter above referred to, but in a notable passage goes on to point out that production is not production in the sense of creation of material objects. "All we can do to matter," he says, "is to cause it to assume useful properties. Labour is not creative of objects but of utilities;" and he proceeds to classify these utilities into those permanently fixed in material objects or in human beings, and those not fixed or embodied in any object, but consisting in a mere service rendered, a pleasure given, or suchlike; and he concludes

that the term productive should only be applied to labour which is employed in creating permanent utilities, whilst utilities of the nature of a service rendered or a pleasure given cannot, he says, be spoken of as wealth except by an acknowledged metaphor. The true principle underlying this distinction seems to be the necessity of the idea of exchangeability as an element in the conception of wealth. But, granting the validity of the distinction, there remains still much room for confusion and error, so long as labour gets the sole credit for the production of those "utilities" in which wealth is said to consist. Our investigations have however sufficed, we think, to show that labour does not naturally tend to reproduce with a profit the wealth consumed in supporting it; that the production of wealth is only possible when labour is under the guidance and direction of intelligence; and that the thinker has a claim to the epithet productive superior to any which can be advanced on behalf of

the labourer. Of course there may be wasted or misdirected thought as well as wasted labour. As Ruskin says, "The true thinker, who has practical purpose in his thinking and is sincere, must be always of infinite use in his generation; but the affected thinker, who supposes his thinking of any other importance than as it tends to work, is about the vainest sort of person that can be found in the occupied classes." In other words, thought must be in co-operation with and in direction of labour if a production of wealth is to result; but this necessity does not impair the supereminent claims of intelligence to the epithet productive.

Do we then suggest that the stigma which was supposed to attach to the classes who do not labour with their hands should be transferred to those who do? Do we come forward to deny the dignity of toil? To these questions we reply that physical labour is frequently combined with mental exertion of a high order, and in any case there is nothing necessarily un-

dignified in physical toil. On the contrary, it exercises an excellent discipline in the formation of character. No one is to blame or be despised because his lot has been cast among the toilers. The world is unequal, and we cannot all be great inventors or calculators, any more than great heroes, or great martyrs, or great poets. But that is no more a reason for denying the scientific fact that great inventors are the chief producers of wealth, than it is a reason for denying the bravery of great heroes, or the genius of great poets.

And then we must remember that being a labourer does not, or at least should not, prevent the labourer from being a thinker also. Labour is entitled to avail itself of the consolation proffered by Mill to the non-labouring classes—namely, that production of wealth is not the sole nor the noblest object of human activity. Labour in itself need not prevent the development of the labourer's mental and moral nature. Undoubtedly, however, the conditions of modern

production are very unfavourable to this development. Labour is largely divorced from intelligence. As Ruskin says, in a remarkable though somewhat alarmist passage: "The foundations of society were never yet shaken as they are at this day. It is not that men are pained at the scorn of the upper classes, but they cannot endure their own, for they feel that the kind of labour to which they are condemned is verily a degrading one, and makes them less than men. This can only be met by a right understanding on the part of all classes of what kinds of labour are good for men, raising them and making them happy, and by a determined sacrifice of such convenience or beauty or cheapness as is got by the degradation of the workman."

But the question of the nature and meaning of production, and the distinction of the two great classes of wealth, receive a further elucidation from the light thrown upon them by the theory of energy.

The conception of wealth does not, we saw, include a mere pleasure or sensation which perishes as it is produced,—a limitation originally derived, as it seems, from the inseparability of the idea of exchangeability from the notion of wealth. Wealth is only wealth so long as it can be stored up or transferred to another—so long as it is not consumed. Thus it is that wealth corresponds only to the idea of potential energy, and does not extend to energy in its active or kinetic form; but the striking circumstance, which we desire now to point out, is that the distinction between the two classes of wealth seems to correspond to a broad scientific distinction applicable to potential energy directly. Whatever be the ultimate nature of matter, there is no doubt that as it presents itself to us its essential qualities depend on the presence of energy,—its solidity and impenetrability upon the potential energy due to the force of cohesion, and its weight on the potential energy due to the force of gravity. Even these objects, there-

fore, which constitute wealth in the secondary sense—luxuries such as diamonds, gold, silver, &c. —present themselves to our consciousness as objects endowed with a certain amount of potential energy, and curiously in their case very often the value seems to increase in proportion to the exceptional permanence or stability of their physical molecular condition, of which the case of diamonds and gold already mentioned are conspicuous examples. But the primary and fundamental and essential and by far the larger portion of wealth consists in those stores of potential energy which minister to maintain the animal life. And the peculiar characteristic of these kinds of potential energy is not permanence, but a high order of instability of physical condition, and hence ready transmutability. The animal life is maintained by transmutations of energy, and so also is the supply of labour.

A piece of coal and a diamond are two very remarkable instances of the same substance,

carbon, in a highly unstable and in an exceptionally stable condition of molecular equilibrium, the one readily transmutable and the other notably the reverse; and they are at the same time two very typical instances of the two great classes into which wealth is divided.¹

The transmutable potential energies, and everything which serves to maintain and augment their quantity, constitute wealth in the primary sense. They alone are capable of being employed as capital. A diamond augments the capital of its possessor, because, satisfying a human desire, it is exchangeable for more or less of any other form of wealth; but it does not, unless by being exported, and so again

¹ It should be added that those objects which we included in the second subdivision of necessities—namely, the clothes, houses, furniture, tools, implements, vehicles, &c., which are employed to aid in the collection and preservation of the primary supplies of potential energy—are also characterised by the feature of molecular stability, without which they could not indeed be so employed, and the economy resulting from their use would be unattainable. Manufactured articles are generally in a more or less permanent physical condition.

exchanged, increase the capital of a country, and in no way does it augment the life and labour-sustaining resources of the world, or at least only to the extent to which, being a cutting instrument, it subserves in some way the maintaining of the supplies of transmutable potential energy. Viewing it, however, as an ornament and not as a tool, it in no way augments the store of wealth available to be employed as capital, because it contains no supply of transmutable potential energy capable of being transformed into work with the results already mentioned. Whilst, therefore, the diamond and such other things are by common consent, and, as we have seen, with perfect justice, included in the idea of wealth, and whilst there is no doubt that the word productive must mean productive of wealth, it is very evident that, in the highest and primary sense, only such thought and labour should be called productive as are devoted to making available objects possessed of supplies of transmutable potential energy,

such as food, coal, &c., or objects such as houses, clothing, diamonds even, when used as tools, which are used in aid of the operation of making available such transmutable potential energy. Such energy is capable of being again consumed in work exerted to put in its place other and larger supplies of similar energy, or, if you like, objects of luxury instead. So long as it is devoted to continually repeated productions of transmutable potential energy, we are engaged in an operation which can be repeated indefinitely, and at each time, if properly and successfully conducted, with the result of a further increase of the supplies necessary to maintain life and support labour. On the other hand, whenever the operations are directed to the acquisition of luxuries such as diamonds, the wealth acquired is quite incapable of being again so devoted, and usually possesses no properties capable of being again consumed or employed either in the support of life or of labour. The labour employed in its acquisition is a pure

sacrifice, and is wholly a deduction from the available supply of potential energy. This is well pointed out in Mill's remarks on expenditure (pp. 88, 89), where, speaking of a man who spends his income chiefly on wines, carriages, and the like, he says: "In the spending, his first stage is also the final stage. That particular amount of the produce of labour has disappeared, and there is nothing left; while, on the contrary, the saving person during the whole time that the destruction is going on has had labourers at work repairing it, who are ultimately found to have replaced with an increase the equivalent of what has been consumed."

So much for the much-argued distinction between productive and unproductive labour; and even although the epithet unproductive may imply no stigma, there is no doubt that as all human power depends upon the possession of supplies of potential energy, the discussion is not without an important bearing upon the political question as to who should be the deposi-

taries of public and political power. Undoubtedly those who are truly productive are those who have this right. Accordingly, we are not surprised to find that the distinction is frequently introduced to be applied in that direction, especially by popular orators who start from the notorious text that labour is the only source of wealth.

Our foregoing argument should, however, have made it very clear now who it is who are most highly entitled to be described as productive. The human being who contributed most to the world's production of wealth was probably, we should think, James Watt. All inventors, astronomers, mathematicians, discoverers, philosophers, and men of science, in proportion as their studies and investigations result in the discovery and illustration of truth, are probably producers of wealth to the greatest extent. Then would follow engineers, architects, shipbuilders, farmers, shipmasters, manufacturers, and artisans.

Labour being, as we have so often repeated, a consumption of wealth, unskilled labourers are

only entitled to be regarded as productive in the lowest degree—skilled labourers, in proportion to their skill and thought, being proportionally higher. There is no doubt that if a strict rule of payment by results be applied—and no other rule has ever, except spasmodically, been in force, nor could any other ever practically be long maintained—there is no doubt, we say, that if such a rule be strictly enforced and applied, the absolutely unintelligent labourer is entitled to no more remuneration from his employer than the exact return of the potential energy equivalent to the labour expended by him. Scientifically he is precisely in the same position as the steam-engine, which is entitled to be fed with new fuel as it consumes the old. This is represented by his wages, and he is no more entitled to any share of the profit over and above this than the engine is. Of course the skilled labourer, and all human labourers require *some* skill, is entitled to a share of profits also in respect of his skill. This is usually, and perhaps most con-

veniently, represented in practice by an additional wage. It will be observed that this system is practically that which now exists and always has existed in every country in which the accumulation of wealth has been successfully prosecuted. For all that, we are by no means apostles of the doctrine that whatever is is right. On many most vital matters we come in conflict with it out and out, and we believe that social and legal privilege still operate to produce much injustice in the fair remuneration both of thought and labour; but we think it well for the benefit of the multitudes, who repeat as the infallible dogmas of political economy the contradictory platitudes of political flatterers, to point out what the truth is really seen to be when the hard and certain facts of science, as mathematically ascertained and demonstrable, are applied to the theory of labour and production of wealth. These facts probably also explain the failure of all attempts hitherto made at what is called co-operative production.

We are the last to suppose that society can, or to wish that it ever should, revert to the paternal form of government, from which, in this century, it has been emerging. But true progress can only be assured if men will recognise that mere physical labour can never hope to usurp successfully the power and influence of the State. Intelligence and thought must be developed as productive instruments in all classes of the community, if the stability of the social system is in future to be maintained.

It is further to be observed that in many cases skill and science are applied to purposes which combine in varying proportions objects which could be described as productive with the gratification of mere passing sensations,—objects useful with objects pleasurable or ornamental. The efforts of a physician or a surgeon are an example of this. The mere relief of pain is combined with the maintenance of living beings in health and strength; and although it is chiefly the motive of relief from pain which frequently

prompts the desire for his assistance, this can no more be cited as a reason for denying to his exertions the title of productive, than does the fact that bread is chiefly sought after to appease the cravings of hunger justify us in denying that epithet to the skill and labour of the baker, the miller, and the farmer. In most departments of his work, and very specially in the performance of all duties connected with the public health, and in almost all research, the physician's skill is applied to objects which are more or less directly productive in a very high degree. And the same argument applies, *mutatis mutandis*, to teachers, to legislators, to architects, and suchlike. The prudent and clear arrangement and adjustment of contracts, settlements, accounts, &c., which form so large a portion of the duties of the lawyer and accountant, are equally entitled to the term productive; and if devoted, as it should be, and very usually is, to the simplification and elucidation of such matters, such skill is truly productive.

A professional man's duty to society is to facilitate and expedite the adjustment of all contracts and such other arrangements, in such a way as to afford to the skill and labour of the contracting parties the fullest and freest scope for exerting itself unhampered by confusion and misunderstanding as to the nature of the contract in which they are engaged. Simplification, therefore, is the bounden duty of all professional men, and ample scope for its exercise will probably always be afforded by the ever-increasing complexity of human affairs. He is not only mistaken in his professional ideal, but positively unproductive and a mere cumberer of the ground who endeavours in any way or to any extent to make business, to manufacture difficulties in order that he may be called in to solve them. It seems to be a greater temptation to make this mistake in the case of distributors than in that of manufacturers, which gives rise to the frequent outcries against middlemen.

The artisan who makes leather into shoes, or

otherwise permanently alters the form of some physical object, appears to augment the store of national wealth quite apart from what he may add to his own share, and in a manner more absolute and durable than the middleman who merely propels such an article from one person to another, retaining as much of its value as possible for his own remuneration. Such middlemen, as well as financiers and dealers in money, appear to exert their intelligence not so much in augmenting the general supply of wealth as in trying to divert as much thereof as possible to their own enjoyment. There is much truth in this idea, but it should be remembered that both the artisan and the middleman are equally engaged merely in altering the position and arrangement of material bodies (although in the one case the result has a more permanent visible form than in the other), and in both cases their own remuneration is equally the motive with which they act. That the general wealth can best be increased by allowing each one to strive, within the limits pre-

scribed by justice, to increase his own share, is the great fundamental principle of the policy of Free Trade—and is possibly the best policy to pursue, at least until such time as men can generally agree upon the objects to which production should be directed, and can safely enforce the pursuit of these upon the whole community.

IX.

The foregoing conclusions evidently involve a theory of political power repugnant to the one man one vote doctrine of modern British politics. Apart altogether from the consideration that no one is entitled to the exercise of power except in so far as and to the extent, different in every individual, to which he is qualified to employ it beneficially, it follows that any such theory of politics, if rigidly applied and carried out, which its inherent absurdity almost necessarily prevents, would shortly become unworkable and inept. It is founded on the assumption that labour as such

is the only source of wealth, and that each man's share of political power should be equalised and limited upon that footing. The electors who receive the control of the national resources for such reasons, will proceed to employ these resources in a manner consistent therewith; to an ever-increasing extent they will demand the expenditure of these resources in providing employment for labour, imagining that so long as labour is employed production is necessarily maintained, and forgetful of the fact that all such labour, unless it is directed to such objects as it would be profitable, as a private enterprise, to undertake, is a direct consumption of wealth, a sheer destruction of national capital, a curtailment therefore of the very resources out of which productive labour can be maintained, and a direct impoverishment of the whole State. In a new and naturally rich country such as America, where there exist abundant natural resources, readily made available without much labour for human uses, such a policy may to a certain extent

be maintained for a long time. But in no country, and especially in no old country, can it be carried to any extent without manifest loss, or to a large extent without national impoverishment.

As a matter of right, it is undoubted that the persons who have truly produced the national resources are the persons who should have the control of these. In their hands alone has political power any right to be reposed, and in their hands alone is there any reasonable hope that the trusts of government will be fulfilled. Of course these persons would, if truly intelligent, delegate the duties of administration partly at least to persons who, without engaging in the direct production of wealth, but perhaps specially in virtue of their abstraction therefrom, had rendered themselves specially qualified for any special duty. Respect for true capacity in whatever quarter it might reside would be a characteristic of such government. But the final repository of power would be the persons who made it available for national purposes. This

doctrine will always involve some share of power being allotted to every intelligent and productive citizen not disqualified by character or any other specialty, and who as resident in the country is directly or indirectly interested in the proper management of its resources,—a share, however, proportional to the extent of the contribution which he does and can make to the production of these resources.

Accordingly, we maintain that the thought, science, knowledge, and skill of a country are always entitled to the principal share of government, and can alone competently perform its functions for any length of time; and proud and intolerant as may be the assertion of the claims of labour at present to overwhelming political power, we have no hesitation in prophesying that in the long-run the still small voice of thought will control the suffrages of modern industry, as its influence has in the past prevailed over the proud pretensions of popes and emperors and armies.

X.

We proceed to point out that the doctrine of energy affords a method of quantifying the indefinite factor in a whole class of problems which the economist is interested in solving.

It enables us to quantify the value of labour by an impersonal and scientific standard entirely independent of wages, and free of all the confusions which Mill and others have so often pointed out as involved in the estimation of the value of labour by reference to the wage paid. The actual amount of labour is now constantly estimated by the amount of force overcome,—foot-pounds being the practical unit employed in the calculation, or more accurately the foot-poundal or erg as a definite unit of work; and these, though primarily applicable to pure mechanical labour, can by inference and comparison be applied to animal labour as well. All this labour bears a direct relation to the amount of energy consumed in its exertion.

But our theory enables us also to calculate the amount of the other element in production, and that the most fluctuating and uncertain—namely, the inherent potential energy of the natural product made available for human uses by the labour expended on it. To employ the language of Mill, we are supplied with a standard to measure “the degree of productiveness of natural agents.”

As we have seen already, if X = the amount of potential energy existing in, say, a piece of coal, and if Y represent the amount of energy necessarily required by the labourers who make it available for human uses, $X - Y$ represents the amount of wealth recovered, or, so to say, produced by the process. It has always been pretty easy to estimate nearly enough the value of the different amounts of labour required to be expended on such processes—*i.e.*, the Y of the above formula; but it has not hitherto seemed possible to attain any standard beyond the exchange value whereby to estimate the amount of the X , and hence it has not seemed possible

to arrive at any such standard estimation of the value of the result $X - Y$. Most important of all: formerly, whilst the X and the Y were not merely regarded as different quantities, but as different entities, the one could not be subtracted from the other except by medium of their money values; now, by showing that wealth and labour can both be stated in terms of energy, science has supplied a means of stating X in terms of Y , and eliminating one or other of the two unknown quantities from the equation.

To determinate this equation has been the dream of economists, and to Mill, and others of his school, it seemed little better than a dream. The suggestion of Adam Smith that labour, or possibly corn, might come to perform such a function, indicated a true though imperfect conception of the sort of standard required; but only when the definite scientific conception of potential energy has been developed, its exact measurement by reference to

constant natural forces, such as gravitation, &c., been achieved, and the great doctrine of the transmutability of its various forms into one another, and into work, been fully demonstrated and established, has the attainment of such an absolute standard of value become a practical possibility.

Of course it is one thing to make such calculations in the region of pure science, and another to apply them quantitatively to the unpurified problems of a practical science like political economy. But the principle can at least be applied qualitatively, so to speak, if not quantitatively, and even this is a gain, and will greatly simplify many economic problems and eliminate many stubborn errors. Not only the theory of values absolute as a basis and foundation of exchange values, but the whole doctrine of cost of production, so laboriously enunciated by Mill, becomes capable of enhanced clearness and abbreviation.

It is substantially the same point which

crops up in the endeavour to estimate the amount of the capital accumulated by the productive process. According to Mill (Book II. chap. xv. sect. 6), the two elements on which, and on which alone, the gains of the capitalist depend are, first, "the magnitude of the produce," depending on "the productive power of labour"; and secondly, the proportion of that produce obtained by the labourers themselves. It is not difficult for us now to see how inadequate a synonym the productive power of labour is for the magnitude of the produce. That produce is the X of the equation we referred to, and it depends upon the amount of the potential energy resident in the natural object made available by the labour (the Y); and the same scientific theory which shows that energy in whatever form it be is homogeneous with, and transmutable into, the energy which supports labour, makes it also clear that the amount of the said X bears no necessary relation to the amount of the labour expended

in producing it. The X must be greater than the Y if there is to be any gain at all; but knowledge of nature and of natural laws and bodies, skill in calculating how best to acquire possession of them, and very often good luck, in the shape, say, of a happy discovery, such as the finding of a rich mine or suchlike,—these are the things which determine the magnitude of the produce and the ratio it bears to the amount of labour consumed.

Thus, if insurance, interest, and wages of superintendence be the three elements of all profit, the two first being the comparatively stationary and calculable elements, the last is clearly seen now to be far more than a mere wage of superintendence. It is the result and reward of the skill and thought which determine whether the productive effort shall be a profit at all, or of the luck which stumbles on an exceptionally large store of natural potential energy. Invention and discovery are indeed the two great sources of wealth.

XI.

The ingenious system of Quesnai and the other French economists receives an interesting illustration from the theories which we are discussing. As is well known, the basis of that system was the axiom that land, and not labour, was the source of wealth; and hence that agriculture alone was truly productive, whilst manufacturing industries, though not useless, were wholly barren and unproductive, merely replacing the capital which they consumed without affording any surplus for accumulation.

Before the division of labour had enabled men to specialise—each man devoting his whole time to the making of some particular thing or the doing of some particular operation—the idea of accumulating a reserve stock would hardly arise or be practicable. Each man would supply the whole of his daily wants as they arose. It was only when one devoted his whole time to making arrows, another to making bows, another clothes,

and so on, that the idea of working a little more than necessary and gradually accumulating a stock of each particular article would develop itself. The advantage of such accumulation would then first come to be appreciated. It is in such stocks not only that capital began, but it is in such stocks also that the conception of wealth originated. Thus it is that the idea of wealth arose out of, and is associated with, the conception of exchangeability; and as we already saw, the necessity of labour as a prerequisite to its production is what gives anything an exchangeable value. So far, therefore, Quesnai is wrong, for, historically, the manufacturer of a rude sort was probably a producer of wealth as soon as the agriculturist. But his theory contains, nevertheless, a remarkable though imperfect recognition of the fact which English economists have only very partially understood—namely, that the value and magnitude of the produce depends not on the productive power of labour, but on the definite and measurable

quantities of the potential energy of nature which the product contains, and which are in no sense created or called into existence by anything that man can do.

Quesnai's theory, in fact, was based on the true distinction between agriculture and manufactures—to wit, that whilst the former adds directly to our supplies of available potential energy, the latter merely alters the form under which these supplies are made use of by men. But he overlooked the fact already pointed out by us (*ante*, pp. 41, 42) that the object of the manufacturing process is to effect an economy in the collection and consumption of these potential energies, and hence it is as truly an efficient factor in augmenting our supplies of wealth as the more directly productive operations of agriculture. Whilst, owing to the greater permanence and stability of physical condition which, as we have seen, characterises the products of manufacturing industry, as contrasted with the products of agriculture, the former are capable

of being accumulated and amassed much more easily than the food-stuffs, which are always in a condition of molecular instability and ready to decay.

XII.

The whole theory of political economy has been tainted by the failure to distinguish between the two sorts of labour, or rather between labour and thought. Results which the philosophic economist attributes to the agency of labour in the widest sense are often quoted by the popular orator as proceeding from the agency of a labour which he understands as purely physical and manual. Of course, provided the distinction is clearly marked out by the constant addition of some adjective, such as labour physical and labour mental, we cannot have any essential objection to the word labour being a portion of the term descriptive of each, any more than we can object to the letter *o* occurring both in the word labour and in the word thought. All we

contend for is that economics, being a science, different terms shall be employed to define two agents which are not only dissimilar, but opposite in their nature, agency, and effect. Of course they have some features in common. Both, when directed to a productive purpose, may be contrasted with pleasure. Both are accompanied with more or less fatigue of the bodily frame, and both are frequently blended and intermixed in actual operation. That is no more a reason for obstinately grouping them together under the name labour and ignoring their distinct influence than it would be for grouping all meteorological phenomena under the word weather, and steadily refusing to recognise the various and conflicting agency of heat and cold, on the ground that they were constantly mixed together, and seldom experienced by themselves; or for an astronomer refusing to distinguish the effects of the earth's diurnal and annual motions, and grouping both under some general name such as motion or rotation.

XIII.

The division of labour in former centuries, and in our century the introduction also of prime motors (of which the principal has hitherto been the steam-engine), have been the two chief means whereby the production and accumulation of wealth have been accelerated, and in both cases it is interesting but difficult to determine the extent to which, in consequence of these, the sphere of influence of thought, skill, and intelligence is increased or diminished. In the case of prime motors, the concentration of power which they have rendered possible has led to the concentration of capital to an extent previously unattainable. In other ways also they have called forth a large development of intelligence, but they have at the same time given rise to the necessity for the assistance of vast numbers of merely dexterous hands. It is remarked by Sir Frederick Bramwell in his opening address to the British Association in

1888, that since the introduction of printing, nothing has done so much for civilisation as the development of these motors, and he argues that their introduction has tended to render unintelligent labour much rarer. We doubt it; but whichever be the truth, there is no doubt that they have economised labour, as in the striking instance given by Sir Frederick of the steam-engine of an Atlantic liner doing the work of 117,000 rowers; and if, as is anticipated, the more minute subdivision of prime motors is in the near future, it may reasonably be hoped that the lessening of the amount of unintelligent labour may be promoted in a marked degree. Certainly their introduction has necessitated very serious modifications on one of the fundamental laws of economics, the so-called law of the increase of labour. According to Mill, the law of the increase of labour is the law of the increase of population. This is only half a truth. The steam-engine is a labourer quite as much as the hodman, and there has been a growing tendency,

as a result of recent discoveries, more and more to employ for the purposes of production the potential energy of fuel or electricity or energy in some other form, rather than the potential energy of food. Thus there has in recent years been an increase in the amount of labour available for the purposes of production far more rapid than even the increase of population, remarkable as that has been.

XIV.

The foregoing argument leads also to the conclusion that there undoubtedly is a sense in which labour, as Adam Smith maintained, is the true price of commodities. The labour necessary to be expended—the Y in our formula—is the true sacrifice which has to be made in order to the attainment or acquisition of a commodity; and the apparent exception to this rule, arising from the fact that the lucky find of some useful object without the expenditure of any labour does not deprive it of its value, is explained by the con-

sideration that the wealth so found is directly, or, by exchange, indirectly capable of supporting so much labour, and thus compensating the sacrifice necessary for the acquisition of some other commodity or portion of wealth. Therefore it is that the increase of labour-saving machinery as invention proceeds, and the greater or less amount of labour required in making available in different countries or climates the necessaries of life, lead necessarily to a variation in the general level of prices in different times, and at different places. And the former of these causes is undoubtedly entitled to receive consideration at the present time, as a factor in the fluctuation of prices which has recently been the subject of such wide discussion. This extension of labour-saving machinery should tend to a general fall in prices, and its influence in this direction should be recognised alongside of, and in conjunction with, the highly important influence of the appreciation of gold. This idea is ably enforced and illustrated by Sir Lyon Playfair

in his recently published papers on the displacement of labour by modern inventions, and on bi-metallism,¹ and has latterly even found recognition in the daily press. See the 'Standard' of 23d December 1888. As we shall see later on, the gain in this way is really much greater than is at first apparent, and probably largely accounts for the great accumulations of wealth which are taking place nowadays, contemporaneously with the prevalence of low prices.

XV.

We can only indicate briefly the light which our argument seems calculated to throw on the popular question of free trade *versus* protection. The controversy is frequently, and we believe not altogether incorrectly, described as a contest between the consumer and the producer. Political economy, as hitherto treated, has been devoted to the science of the production and dis-

¹ Subjects of Social Welfare, p. 126. 1889: Cassells & Co.

tribution of wealth, and has dealt only incidentally with the perhaps equally important subject of its consumption. It lays down the laws according to which wealth may most efficiently be accumulated, not the principles in accordance with which it may most beneficially be expended or consumed. Even the distribution of wealth is in political economy merely a name for what might more strictly be called the final stage in its production, the last step in the process whereby the rude energies of nature are rendered available to the satisfaction of human needs. But so long as the amount of such energies is augmented, political economy has no concern whether it be largely accumulated in a few hands, or widely scattered amongst many; nor whether the distribution which actually prevails is in accordance with the justice of the case, or with the true happiness of the possessors.

For thus resolutely confining itself to the specific problem which it is called upon to treat and solve, political economy has been stigmatised as

the dismal science; and as modern methods of production seem frequently to favour the accumulation of vast quantities of wealth in a few hands, political economy has lately come to be looked upon with suspicion, as very much a gospel of the privileges of the few against the interests of the many. The fact is, that whilst political economy points out the methods by which wealth may most rapidly be produced and made available, other science—sanitary science, ethical science, or the science vaguely called social—is quite entitled to step in and say that the rapid accumulation of wealth should not be the sole object of human endeavour; and that in the particular method which political economy would consider the most efficient, there may lurk dangers to the true wellbeing of the race, which more than counterbalance its economical advantages. But this should involve no attachment of blame to the political economist for confining himself to his own subject-matter, any more than a mathematician should be blamed for asserting

that the quickest way of getting from the top to the bottom of a high tower would be to jump over the parapet, although medical science, or perhaps even common-sense, might step in to suggest counterbalancing disadvantages.

These considerations apply directly to the confused controversy which has been in progress for some time between the producer and the consumer of wealth. The less consumption and the more abstinence there is, the more rapid will be the accumulation of wealth, and particularly of capital available for sustaining a constantly increasing production. But if the question be put, At what rate is it most advantageous to the best interests of the people that wealth should be accumulated? How much is to be saved for the future, and how much is to be spent and consumed at the moment? These questions in the nation, as well as in the individual, must be determined by the application to the constantly varying circumstances of the case of the widest ethical laws, with the study

and application of which the political economist is not primarily concerned.

But an important distinction arises here again in connection with the discrimination between the two classes of wealth. The more we cheapen corn and other such necessities of life, the more do we as a main result reduce the cost of labour, and thereby render possible an increased production of wealth. Even if the benefit of the cheapening remains with the labourer, at any rate his comfort and efficiency are increased without counterbalancing loss, and almost certainly with advantage to the productive process. It is quite otherwise with luxuries. An increase in their consumption cannot possibly involve any increase of capacity for labour, and must almost necessarily have a quite opposite consequence. Its advisability must therefore be supported on non-economic grounds, such as that the augmented happiness and comfort which the anticipated consumption will occasion will be more of a benefit to the country than the consequent

reduction or less rapid increase of wealth will be of an injury.

Whilst, therefore, the reasons which support free trade and condemn protection in the case of necessities, such as corn, may partly at least be derived from the laws of economics, it is quite otherwise with luxuries, with such cases as that of, say, the sugar duties. Sugar in a separate state is a luxury and not a necessary, and its taxation does not increase the price or diminish the efficiency of labour, and cannot in any way retard, but may favour the production and accumulation of wealth. It accordingly appeared to Adam Smith to be a very suitable object of taxation.¹ Sugar, alcohol, and tobacco were, as he pointed out (Book V. chap. iii.), the three great imported luxuries which are in wide general consumption by the community of this country; and the taxation of sugar secured for the revenue a large but very unoppressive con-

¹ *Wealth of Nations*, Book V. chap. ii. part 2, article 4, Taxes on Consumable Commodities, paragraph 10.

tribution from the bulk of those who are not affected by the other two imposts. Nevertheless the abolition of these duties became an object of Radical agitation soon after the repeal of the Corn Laws, and was urged by numerous politicians who imagined they were armed with the same logic which was available against the duties on corn, until ultimately, with the assistance of Conservative timidity, the duties were swept away, and a useful and most innocuous source of revenue was foolishly abandoned.

XVI.

We shall only refer to one other question upon which we think a considerable amount of light is shed by attending to the distinctive characteristics of necessities and luxuries, as we have endeavoured to bring them out. Nothing is more common or more popular than to denounce all arguments and conclusions derived from the monthly Board of Trade Returns as illustrating

the state of the so-called balance of trade. In Adam Smith's time, the balance of trade was estimated mainly from the course of the foreign exchanges, as showing whether Great Britain was exporting or importing gold from any particular country; and the mercantile theory being based on the absurd idea that national wealth was commensurate with the amount of the precious metals held by any country, a laborious, vexatious, and in result ineffectual system of taxation and bounty was established, with the object of directing commerce so as to effect an importation rather than an exportation of gold.

It was this monstrous and erroneous system that Adam Smith attacked, showing—first, that the course of exchange furnished no complete information as to what the actual balance really was; second, that the taxes and bounties in question failed utterly to attain even the end they had in view; third, that that end, even if attained or attainable, was not always or often calculated to lead to an increase of national

wealth, and in no case was worth the sacrifices, loss, and injury which the vexatious system entailed. He made one mistake, however, in failing to observe that whilst the precious metals were far from being the only constituents of national wealth, they nevertheless occupy a more advantageous position in respect of productive efficiency—power to be used as capital—than do these portions of the national wealth which come under the category of luxuries. “If a hundred thousand pounds of English gold,” he says, “purchase French wine, which in England is worth a hundred and ten thousand pounds, this exchange will equally augment the capital of England by ten thousand pounds. As a merchant who has a hundred and ten thousand pounds’ worth of wine in his cellar is a richer man than he who has only a hundred thousand pounds’ worth of tobacco in his warehouse, so is he likewise a richer man than he who has only a hundred thousand pounds’ worth of gold in his coffers. He can put in motion a greater quantity

of industry, and give revenue, maintenance, and employment to a greater number of people than either of the other two” (Book IV. chap. iii. part 2, 7). The partial fallacy of this statement lies in the last sentence. So long as his wealth remains in the form of gold, it is at least possible that the merchant will employ it in supporting some form of production which tends to multiply and repeat itself. Whenever it has been expended upon the purchase of a hundred and ten thousand pounds’ worth of wine, that power has been transferred to the French seller, and although the individual English merchant may be enriched, the national resources have been lessened, because his wealth has been transformed into a shape in which it is no longer available to support life or labour, and will soon all be consumed in the mere gratification of unproductive pleasures and desires. In confirmation of our contention, we have only to refer to the passage already quoted from Book II. chap. i., in which the very point we are

making is quite clearly brought out. (*Ante*, pp. 16, 17.)

What Smith was chiefly contending for, however, in his fourth book, was the absurdity of attempting, by an elaborate, vexatious, and yet abortive system of duties and bounties, to carry out a theory which would rather stop commerce altogether than allow it to proceed when the course of exchange seemed to be against this country. Even here, however, he did not omit to distinguish between the so-called balance of trade and the absolute balance of production and consumption, upon which, as in the same chapter he plainly shows, the increase or diminution of the national wealth directly depends.

That the Board of Trade Returns are imperfect; that in considering them we should carefully distinguish between imports of raw materials intended for manufacture, imports of corn intended to sustain useful labour, and imports of luxuries intended to be unprofitably

consumed, is all very true; that, in addition, we should also keep in view the enormous remittances which have to be made from other countries in payment of interest on British capital now invested abroad. All this may be true. It is none the less certain that these returns throw most valuable light on one item on each side of the account which states the balance of the national production and consumption of wealth. Their importance and significance in this respect are definite and specific, and cannot be set aside by unintelligent diatribes against the balance of trade, in some of which it is actually a fact that eminent statesmen have asserted that our imports represent an item of the national income and our exports of the national expenditure.

The great Liberal policy of the nineteenth century, so far as dealing with economic questions, has been mainly an application of the doctrine of free trade as enunciated by Adam Smith, the principle of which was to give free scope to the

production of wealth by the most expeditious methods, selected by the producers themselves, and to remove all restrictions upon such methods, imposed from considerations of military policy, class interests, or the like. The theory may be largely a sound one. But in the rapid disintegration of political principle which has been in progress throughout Europe during the last twenty-five years, it is curious to find its professed disciples,—on the one hand pressing it to undreamt-of extremes, by rejecting the restrictions imposed from considerations of morality, justice, or social or national safety; and on the other hand, assailing the very accumulations of wealth which that policy has rendered possible.

Underlying the conflicting criticisms of this policy, there is one line of argument, the force and meaning of which have been but vaguely apprehended, either by those who made it, or by those to whom it was addressed.

The substitution of machinery and non-vital prime motors for manual labour, and of large

factories with much subdivision of labour for small workshops, is simply a carrying out of the principle of reducing the Y in our formula to a minimum, and so rendering the remainder of $X - Y$ (*i.e.*, the wealth produced) the greater. But the *ultimate* object of production is to support life, not steam-engines, and the portion of the Y abstracted from the support of life and devoted to the support of machinery by such changes, must be more than counterbalanced by the greater magnitude of the remainder, or the change, though resulting in a greater production of wealth, does not render a greater amount available for the object which production has in view. We have no doubt that generally this objection may not lie; but it is always worthy of attention, and its soundness in each particular case is to be determined, not by declamatory apostrophes to the shades of Cobden and Adam Smith, but by careful arithmetical calculation of the relative magnitude of the quantities represented by the X and Y of our formula, and the

proportion of each employed in sustaining human life.

In the same way, whilst we have no doubt that it is generally more profitable for a country to buy in the cheapest market, although a foreign one, than from a home producer who, by aid of fiscal protection, can claim a higher price,—it is not to be forgotten that, although such artificial augmentation of the price—the *Y*—may lessen the remainder of *X-Y* available to support the national life, still, if the *Y* itself is in the latter case devoted to support life and labour in the home country instead of abroad, the protectionist policy may enable more life to be supported within the particular country than does the other. We do not think that it will often do so, but the determination of the problem must be decided in each separate case by calculation on the above lines.

XVII.

We proceed now to a cognate inquiry which, if not suggested directly by the foregoing discussion, is nevertheless promoted by the light derivable from the principles discussed.

The question of the true nature of the interest of money and rent of land has throughout the whole Christian era, and long before the rise of political economy, been a keenly contested point, both in ethics and in jurisprudence, and it may be even said in theology itself.

The orthodox doctrine of the middle ages justified the exaction of a rent for land, on the ground that land yielded natural annual fruits; but condemned as usurious the taking of interest on money, for the reason that money produced no such natural increase. The facility with which this distinction could be evaded by the granting of bonds of annual-rent from lands in security of money lent, and the gradual growth of commerce, and the practical necessities to which that

growth gave rise, gradually drove the scholastic view of interest off the field, even before the economist had come forward to explain that money was a mere sign or symbol for some produce or commodity, for the use of which the interest was really paid. And now the popular tendency appears to be in the exactly opposite direction, and to be condemning the rent of land as something unnatural and unjust, whilst freely permitting and protecting the exaction of interest upon money lent.

Now, according to the political economists, capital is the result of abstinence, and interest consequently the reward of abstinence.

There is no doubt that frequently—perhaps in this commercial age we may say generally—capital is the result of saving, of abstaining from consuming, wealth available for consumption. And in an argument which contains, we think, almost the only trace of sophistry to be met with in the writings of that most candid of thinkers, Mill endeavours to show that it is always the

result of abstinence. Even where, as in the case of a lucky find of a coal-mine or a gold-mine, it is not directly the result of premeditated saving, Mill contends that, as the capital could be consumed unproductively and is not so consumed, it is entitled to be regarded as the result of abstinence. The tension of the expression is further increased when we proceed to describe interest as being in such circumstances the reward of abstinence. We object to the whole definition on several grounds.

The definition, being simply equivalent to wealth not consumed, is negative, not positive, as would be the definition "wealth devoted to the maintenance of the productive process." Again, it is loose, inexact, unquantifiable, and defines a material, or at least a physical, subject by reference to a fluctuating moral quality which varies in every different individual case.

A little consideration will soon show us a much more fundamental explanation of the true nature of capital and interest.

For if capital be the result of abstinence,

why does any one, why at any rate and especially do the most saving and abstemious persons, so frequently borrow? Why not themselves practise the necessary abstinence, and thus accumulate the necessary capital for themselves? The true answer is very obvious and simple; indeed so simple, so very evident, so like a truism, as perhaps almost to seem no answer at all.

It is simply because of the advantage involved in the gain of time in all physical operations. The capitalist lender had his capital sooner than his borrower, and the interest paid him for its use is ultimately and truly to be defined as the premium on PRIORITY.

But is this not also a true description and definition of the rent of land?

Private property in land takes its origin in preoccupation, and the rent paid to the owner is the premium on the advantage which he has obtained by his priority. Nay, more; this explanation simplifies the contending theories as to the limits and functions of rent.

On the one hand, we have the exponents of the Ricardian theory maintaining that rent is measured by the extra productiveness of the land for which it is paid over the productiveness of the worst land which it is profitable to cultivate,—a theory which does not apply conveniently to non-agricultural rents. On the other hand, we have the American writers and others pointing out with undoubted truth that high rents are paid for old and exhausted lands in some places, whilst vast tracts of virgin richness are left unploughed.

The true measure of the rent of any portion of land seems to be the amount of the advantage which its position gives it in respect of a priority in time in the process of production, such as nearness to markets, or to water-power, or some other store of potential energy distributed throughout the soil, or readily accessible to its cultivator.

Now the curious fact which must next be noticed is this,—the gaining of time in any process involving physical work, as we have

scientifically defined it, involves a consumption of potential energy, just as any other expenditure of work does. The work done in moving any material body involves the expenditure, as we have seen, of so many foot-pounds of energy; but the important fact is that an acceleration of motion, as it is scientifically termed, also involves a similar expenditure of a definite and measurable quantity of energy. Nay, the kinetic energy of a moving body increases in proportion to the *square* of its velocity. Work done in causing acceleration—*i.e.*, in gaining time—is thus convertible into and quantifiably comparable with work done against the force of gravity or any other natural force.

Now, then, we have the important conclusion that the interest of capital and the rent of land are generically of the same character and nature as the wage paid for labour, or the money spent on coal for the steam-engine, or oats for the cart-horse. And in theory at least, however difficult it might be to work out the details in practice,

we have a definite standard whereby scientifically to measure the true rent which any portion of land is at any particular moment really worth, and the true rate of interest which should be paid for any particular loan. It follows also that whatever complaint against interest of capital and rent of land may be competent to a thinker or inventor, no objection can consistently lie in the mouth of any physical labourer.

XVIII.

The claim of PRIORITY to a share of wealth, although generically the same, is specifically different from the claim of labour, and it is one of the two great claims whose conflict constitutes the warfare of modern politics. The other claim is probably best described as the claim of MAJORITY, and we shall explain how.

It will probably be admitted that, generally speaking, the claim of priority represents an arrangement originally acquiesced in by those

interested. And generally also an equilibrium, at least temporary, was established, and an agreement come to, based on the superior power or other advantage of the parties to whom the priority was conceded. And hence it is that statute law and the sanctity of contracts are commonly ranged on the side of the priority claimants. "*Prior tempore potior jure*" and "*Melior est conditio possidentis aut defendentis*," are the maxims which support that claim.

It is the accession of additional claimants not present originally, but now claiming interest, which reopens the question, which transfers to the assailants the majority formerly on the side of those now maintaining the priority claim, which at any rate augments markedly their majority, and invokes the principles of equity and equality in favour of a new distribution.

The claim of priority and the claim of majority, then, or the *status quo* against the initiative, as Victor Hugo calls them,—these are the two opposing claims whose conflict runs through the

whole complexity of the political struggle—through our disputes about rent, capital, primogeniture, debt, and often even the private claims of opposing individual litigants.

Opposing parties and individuals speak each of their rights, but there can be no opposition of rights: we speak, therefore, advisedly of a conflict of claims. Rights never overlap, and the problem—and it is a problem which no theory can render simple—is to determine where the claims exceed the rights, and where precisely they coincide. That is at least a very principal portion of the functions of the jurist, of the judge, of the moral philosopher, and of the politician; nor do we propose here to enlarge at length upon the way in which the solution of that problem should be set about. Suffice it to reiterate the well-worn maxim that the truth generally lies between two extremes, and that *audi alteram partem* must be the inquirer's rule.

The moral system of Christ, proclaimed as it

was in open opposition to all the reigning powers and principles which it found in possession of the human heart, and embodying the very chiefest maxims of equity in the clearest and most decisive form, is not likely to be suspected of any great predilection for the priority claim. Yet Christ himself, in the parable of the labourers in the vineyard (Matthew xx.), plainly shows that equity and equality are not always entitled to demand the revision of a bargain made, and that the highest justice cannot always condemn an economy under which many are called but few chosen.

THE END.

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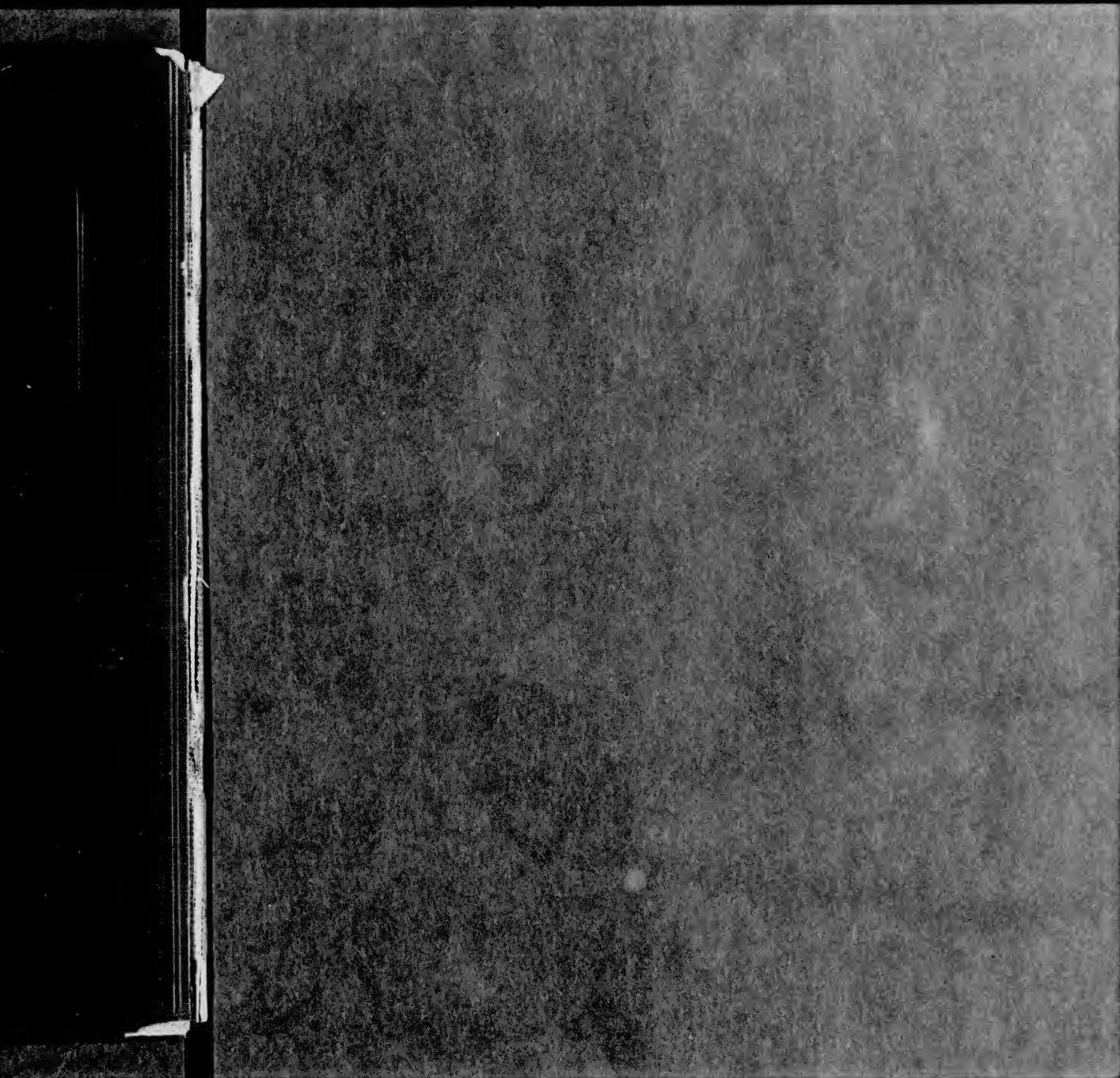
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